Deepwater Port License Application for Proposed Offshore Liquefied Natural Gas Terminal in the Gulf of Mexico

Gulf Landing Project

Volume I (Public)

October 2003

Submitted by:

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October 30, 2003

Rear Admiral Thomas H. Gilmour
Commandant (G-M)
United States Coast Guard
2100 Second Street SW
Washington, D.C. 20593

Attn: Commander Mark Prescott

Re: Gulf Landing
Application for License for a LNG Deepwater Port

Dear Admiral Gilmour:

Pursuant to the Deepwater Port Act of 1974, as amended, and the United States Coast Guard's (U.S. Coast Guard's) Regulations[1], Gulf Landing LLC (Gulf Landing) hereby files an application for a license to construct, own and operate a deepwater port for the purposes of unloading, storing, vaporizing, and delivering imported liquefied natural gas (LNG) supplies into the country's natural gas pipeline infrastructure, as more fully described in the application.

Description of Proposal

Gulf Landing proposes to construct, own, and operate a LNG terminal consisting of two concrete gravity base structures (GBSs), in Block 213 in the West Cameron Area (WC 213) in the Gulf of Mexico (GoM) Offshore Louisiana. This location is approximately 38 miles (61 kilometers [km]) offshore and is adjacent to an existing shipping fairway serving the Calcasieu River and area ports. The terminal will be capable of storing up to 180,000 cubic meters (m^3) net of LNG and vaporizing up to 1.2 billion cubic feet per day (Bcfd). As part of the deepwater port, Gulf Landing proposes to construct, own, and operate up to five (5) takeaway pipelines that will interconnect with existing natural gas pipelines located in the GoM. From these pipelines, the natural gas will enter the onshore national pipeline grid for delivery to any consumption market east of the Rockies. Gulf Landing anticipates unloading and vaporizing approximately 7.7 million tonnes of LNG per annum based upon an average daily send-out of 1 Bcfd.

Contents Enclosed

Per instructions from representatives of the U.S. Coast Guard, Gulf Landing is arranging for the filing of six (6) complete hardcopies of its application for a deepwater port license with the U.S. Coast Guard along with two (2) electronic copies contained on enclosed CD-ROMs. The copies of the application are being forwarded under separate cover. Each application in hardcopy consists of four

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[1] 33 Code of Federal Regulations (CFR) §148.101

volumes. Volume I, labeled "General" consists of the application components that are releasable to the public. Volume II, labeled "Environmental Review" consists of an environmental report that is also releasable to the public. Volume III, labeled "Attachments" which is being filed under seal, consists of infrastructure information and studies that are confidential and proprietary in nature. Volume IV, labeled "Financial" which also is being filed under seal, consists of certain confidential financial information being provided only to the U.S. Coast Guard and the Maritime Administration. The accompanying CD-ROMs are similarly labeled with the exception that CD 1 contains the electronic equivalent of Volumes I and II. Gulf Landing hereby requests that the U.S. Coast Guard treat Volumes III and IV (hardcopies), and, corresponding CDs 2 and 3 (Attachments and Financial, respectively) as confidential and proprietary information and not disclose such information to the public.

A check for $350,000 (U.S.) made payable to the United States Treasury is enclosed as an application filing fee. This filing fee is being filed pursuant to Section 148.125(a) of the proposed regulations as set forth in Docket USCG 1998-3884 (67 Fed. Reg. 37919, May 30, 2002, the Proposed Regulations).

The contents of the application are arranged in the order as provided in Section 148.105 of the Proposed Regulations. The instant application is based on Gulf Landing's good faith interpretation of the requirements of the Proposed Regulations[2]. Therefore, Gulf Landing requests the ability to modify or supplement the information supplied in its original application in the event it is necessary to do so without impeding the application processing timeline.

Gulf Landing is also forwarding under separate cover three (3) copies of the following survey reports:

- "Archaeological and Hazard Report, Block 213 West Cameron Area" dated June 2003, prepared by C&C Technologies; and,
- "Archaeological, Engineering, and Hazard Report of Five Proposed Pipelines within West Cameron Area Gulf of Mexico" dated September 2003, prepared by Fugro Geoservices, Inc.

Both surveys were conducted under Section 148, Subpart E of the U.S. Coast Guard's Regulations. The surveys are being filed under seal as they contain information of a confidential and proprietary nature such that publication of these reports could result in commercial and competitive harm to Gulf Landing.

In addition to the above, Gulf Landing is enclosing three additional copies of this transmittal and requests the U.S. Coast Guard date-stamp the copies and return them for the files of Gulf Landing.

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[2] The Proposed Regulations reflect the most current policies and requirements for preparing and filing a *crude oil* deepwater port license application. As a result, some interpretation and translation are necessary for an applicant to prepare and process a *LNG* deepwater port license application.

Service and Correspondence

The names, titles and mailing addresses of persons to whom correspondence and communications concerning this filing should be directed are as follows:

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A "Statement Certifying Application" is attached hereto and is being provided pursuant to Section 148.109(d) of the U.S. Coast Guard's Regulations.

Respectfully submitted,
Gulf Landing LLC

A. Y. Noojin III

A. Y. Noojin, III
President
Gulf Landing LLC
1301 McKinney, Suite 700
Houston, Texas 77010

[3] Primary contact for legal service.
[4] Primary contact for non-legal service.

Deepwater Port License Application for Proposed Offshore Liquefied Natural Gas Terminal in the Gulf of Mexico
Gulf Landing Project

Submitted in four Volumes as follows:

Volume I (Public), License Application and Appendices (herein)

Volume II (Public), Environmental Review

Volume III (Confidential), Attachments

Volume IV (Confidential), Financial

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Volume I: General (Public)
Table of Contents

Volume I (Public), Table of Contents, *continued*

List of Tables

List of Illustrations

List of Appendices

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Volume II (Public)
Environmental Review
Table of Contents

The Environmental Review is provided under separate cover.

APPENDICES

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Volume III (Confidential)
List of Attachments
Table of Contents

These confidential attachments are provided under separate cover.

Volume III (Confidential), List of Attachments, *continued*

Volume IV (Confidential)
Financial
Table of Contents

Financial information is provided under separate cover.

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Glossary and List of Acronyms, and Abbreviations

°C: degrees Celsius.

°F: degrees Fahrenheit.

ABS: American Bureau of Shipping.

AC: alternating current.

ACI: American Concrete Institute.

AFBMA: Anti-Friction Bearing Manufacturers Association.

AFFF: aqueous film-forming foam.

AISI: American Iron and Steel Institute.

ANSI: American National Standards Institute.

API: American Petroleum Institute.

Applicant: see Gulf Landing LLC.

ARPA: *see* automatic radar plotting aid.

ASME: American Society of Mechanical Engineers.

ASTM: American Society for Testing and Materials.

automatic radar plotting aid (ARPA): a type of radar system with a built-in collision avoidance alarm.

bar: a metric unit of atmospheric pressure, equal to about 14.503 78 pounds per square inch (psi). One bar is slightly less less than the average pressure of the Earth's atmosphere, which is 1.013 25 bar. In practice, meteorologists generally record atmospheric pressure in millibars (mb). In English-speaking countries, barometric pressure is also expressed as the height, in inches, of a column of mercury supported by the pressure of the atmosphere. In this unit, one bar equals 29.53 inches of mercury (in Hg).

barg: bar gauge; a common unit of pressure in engineering; *see also* bar. The term "gauge" means that the pressure has been read from a gauge that measures the difference between the pressure of the fluid or gas and the pressure of the atmosphere.

barrel (bbl): a volumetric unit used in the petroleum industry, equivalent to 42 U.S. gallons or 148.99 liters.

bbl: *see* barrel.

Bcfd: billion cubic feet per day.

blackwater: sanitary (sewage) waste from toilets and urinals.

BOG: *see* boil-off gas.

boil-off gas: natural gas that evolves from the LNG due to heat ingress.

bopd: barrels of oil per day.

bpd: barrels per day.

BS: British standard.

buoy: an anchored float serving as a navigation mark or to show reefs, etc., also, a lifebuoy.

CCR: central control room; will be located in the quarters building on the quarters platform.

CCTV: *see* closed-caption television.

CFR: Code of Federal Regulations.

CINI: *see* Comissie Isolatie Nederlandse Industrie.

closed-circuit television (CCTV): a television system that is not broadcast but closed (transmitted by cable), typically used for monitoring equipment operations, and various areas of a facility.

CO: carbon monoxide.

Coast Guard: United States Coast Guard.

coastal zone: The coastal waters (including the lands therein and thereunder) and the adjacent shorelands (including inshore waters) strongly influenced by each other and in proximity to the shorelines of the several coastal states. The zone includes islands, transitional and intertidal areas, salt marshes, wetlands, and beaches, and extends seaward to the outer limit of the United States territorial sea. The zone extends inland from the shorelines only to the extent necessary to control shorelands, the uses of which have a direct and significant impact on the coastal waters. Excluded from the coastal zone are lands, the use of which is by law subject to the discretion of, or which is held in trust by the federal government, its officers, or agents.

Comissie Isolatie Nederlandse Industrie (CINI): a foundation that cooperates with companies regarding standardization in the field of thermal insulation for industry.

CPI: corrugated plate interceptor.

CSA: Continental Shelf Associates, Inc.

CWA: Clean Water Act.

CZMA: Coastal Zone Management Act of 1972.

dB: decibels.

dBm: decibels (referenced to milliwatts).

DC: direct current.

DCS: *see* distributed control system.

DEP: design and engineering practice.

discharge: to pour forth fluid or other substance; discharge rate is the flow rate of a fluid at a given instant expressed as volume per unit of time.

distributed control system (DCS): typically, a control system which provides for independent process control cabinets (systems) distributed throughout a facility, connected to a data-highway, with ultimate supervisory control from a mainframe computer.

DMC: Delta Marine Consultants bv.

DnV: Det norske Veritas.

DnV: Det Norske Veritas.

DODEP: (Shell) Deepwater Offshore Design and Engineering Practice.

dolphin: a bollard, pile or buoy for mooring, also a structure for protecting the pier of a bridge.

DWPA: Deepwater Port Act of 1974, as amended.

E & E: Ecology & Environment, Inc.

e.g.: for example.

EDG: emergency diesel generator.

EFH: essential fish habitat.

EIA: *see* Energy Information Administration

emergency position-indicating radio beacon (EPIRB): an emergency locator radio signal that activates the search and rescue network when activated.

Energy Information Administration (EIA): a statistical agency of the U.S. Department of Energy. Its mission includes providing policy-independent data, forecasts, and analyses to promote sound policy making, efficient markets, and public understanding regarding energy and its interaction with the economy and the environment.

EP: engineering practice.

EPIRB: *see* emergency position-indicating radio beacon.

ER: environmental review.

ESD: emergency shutdown.

ESS: emergency support system.

ethernet: the most widely installed local area network (LAN) technology using various transmission media, such as coaxial cables, unshielded twisted pairs, and optical fibers; however, ethernet is also used in wireless LANs.

ETSP: equipment technical specification.

FAA: Federal Aviation Administration.

FCC: Federal Communication Commission.

FCI: Flow Control Industries.

FDA: (United States) Food and Drug Administration.

FERC: Federal Energy Regulatory Commission.

FPS: floating production system.

FPSO: floating, production, storage, and offloading.

FRP: fiber-reinforced plastic.

FSRU: floating storage and regasification unit.

ft: feet.

ft^3: cubic feet.

GBS: gravity base structure.

GHz: gigahertz; 1 billion hertz.

GoM: Gulf of Mexico.

gpm: gallons per minute.

graywater: domestic waste such as discharge from galleys, sinks, safety showers, eye wash stations, hand wash stations, and laundries.

Gulf Landing LLC: the limited liability company formed in the State of Delaware on January 7, 1998 (formerly known as Tejas Midstream Enterprises LLC, formerly known as Shell Midstream Holdings LLC), that is filing this new entry deepwater port license application; also the Applicant; also Gulf Landing.

Gulf Landing terminal: a deepwater port to be used for the receipt, storage, regasification, and delivery of liquid natural gas, the subject of this application; also the terminal.

Gulf Landing: see Gulf Landing LLC.

HAP: hazardous air pollutants.

HAZID: hazard identification.

hertz (Hz): the modern term for "cycles per second;" the number of times per second that a wave passes a given point.

HFE: Human Factors Engineering.

HI: Hydraulic Institute.

HMI: human-machine interface.

HP: horsepower.

HSE: health, safety, and environment.

Hz: *see* hertz.

I & C: instrumentation and control.

i.e.: that is.

IA: instrument air.

ICSI:

IEC: International Electrotechnical Commission.

IFV: intermediate fluid vaporizer.

IMO: International Maritime Organization.

IP: implementation procedure.

IPCEA: Insulated Power Cable Engineers Association.

IPS: instrumented protective system.

ISA: Instrument Society of America.

ISO: International Standards Organization.

km: kilometer; 1,000 meters.

kV: kilovolts.

LAN: *see* local area network.

lease: any form of authorization that is issued under Section 8 or maintained under Section 6 of the Outer Continental Shelf Lands Act and that authorizes exploration for, and development and production of, minerals.

liquified natural gas (LNG): Natural gas (primarily methane) that has been liquefied by reducing its temperature to minus 260 degrees Fahrenheit at atmospheric pressure. (The volume of the LNG is 1/600 that of the gas in its vapor state.)

LLC: limited liability company.

LNG: *see* liquified natural gas.

local area network (LAN): a computer network that spans a relatively small area. Most LANs are confined to a single building or group of buildings; however, one LAN can be connected to other LANs over any distance via telephone lines and radio waves. A system of LANs connected in this way is called a wide-area network (WAN).

LOOP: Louisiana Offshore Oil Port.

LP/HP: low pressure/high pressure.

LPG: liquefied petroleum gas.

m/s: meters per second.

m^3/hr: cubic meters per hour.

m^3: cubic meters.

MARIN: Maritime Research Institute Netherlands.

MAPOL: International Convention for the Prevention of Pollution from Ships.

MAWP: maximum allowable working pressure.

mg/L: milligram per liter.

MGI: Marine Geological Institute.

MHz: megahertz; 1 million hertz.

mile(s): One (1) statute mile equals 5,280 feet.

MLLW: mean lower low water.

mm: millimeter.

MMbopd: million barrels of oil per day.

MMS: (U.S. Department of the Interior) Minerals Management Service.

MMscfd: million standard cubic feet per day (measure of gas produced in a reservoir).

MPa: megapascal.

MPMS: Manual of Petroleum Measurement Standards (American Petroleum Institute).

mtpa: million tonnes per annum.

MW: megawatt.

National Oceanic and Atmospheric Administration Geophysical Data System (NOAA GEODAS): GEOphysical DAta System is an interactive database management system developed by NOAA's National Geophysical Data Center (NGDC) for use in the assimilation, storage and retrieval of geophysical data.

National Pollutant Discharge Elimination System (NPDES): As authorized by the Clean Water Act, the NPDES permit program controls water pollution by regulating point sources (i.e., discrete conveyances such as pipes or man-made ditches) that discharge pollutants into waters of the United States.

natural gas: either natural gas unmixed, or any mixture of natural or artificial gas, including compressed or liquefied natural gas.

nautical mile: A distance of one minute of arc of latitude equal to 1.1508 statute miles

NEC: National Electric Code.

NEMA: National Electric Manufacturers Association.

NFPA: National Fire Protection Association.

NMFS: National Marine Fisheries Service; now National Oceanic and Atmospheric Administration Fisheries Division (NOAA Fisheries).

NOAA Fisheries: National Oceanic and Atmospheric Administration Fisheries Division; formerly the National Marine Fisheries Service (NMFS).

NOAA GEODAS: *see* National Oceanic and Atmospheric Administration Geophysical Data System.

NO_x: nitrogen oxides.

NPDES: *see* National Pollutant Discharge Elimination System.

NPSH: net positive suction head.

NPSH: net positive suction head.

NS: Norwegian standard.

OCIMF: Oil Companies International Marine Forum.

OCS: *see* Outer Continental Shelf.

oil: as defined in Section 311(a)(1) of the Clean Water Act, oil of any kind or in any form, including, but not limited to, petroleum, fuel oil, sludge, oil refuse, and oil mixed with wasters other than dredged spoil.

OP: operating procedure.

operator: an individual, partnership, firm, or corporation having control or management of operations on a leased area or portion thereof. The operator may be a lessee, designated agent of the lessee, or holder of operating rights under and approved operating agreement.

ORV: open-rack vaporizer.

Outer Continental Shelf (OCS): All submerged lands that comprise the continental margin adjacent to the United States and seaward of state offshore lands and extending from state waters to the limit of the U.S. Exclusive Economic Zone.

PA: plant air.

PA: public address.

PABX: *see* private automatic branch exchange.

PCPT: piezocone penetration test.

PFD: personal flotation device.

platform: a steel or concrete structure from which offshore development wells are drilled.

PLC: programmable logic controller.

PM_{10}: particulate matter of 10 microns or less.

PPE: personal protection equipment.

ppm: parts per million.

private automatic branch exchange (PABX): a telephone exchange operated within an organization, used for switching calls between internal lines and between internal and public switch telephone network (PSTN) lines.

process area: the portion of the terminal that performs the regasification function and includes platforms, bridge support structures, and four bridges.

production: activities that take place after the successful completion of any means for the extraction of resources, including bringing the resource to the surface, transferring the produced resource to shore, monitoring operations, and drilling additional wells or workovers.

psi: pounds per square inch.

psi: pounds per square inch.

psig: pounds per square inch gauge.

PVC: polyvinyl chloride.

QC: quality control.

regasification: changing the state of LNG from liquid to gas phase.

riser: the length of pipe that extends from a subsea production system up to a fixed or floating production platform in the offshore environment. Risers are the conduit for transferring the hydrocarbons produced by the subsea system to the processing facilities on the platform.

RO: reverse osmosis.

ROV: remotely operated vehicles.

RP: recommended practice.

SART: *see* search-and-rescue radar transponder.

scfd: standard cubic feet per day.

SCV: submerged combustion vaporizer.

search-and-rescue radar transponder (SART): a type of short-range rescue homing beacon.

send-out: daily throughput.

Shell NA LNG LLC (SNALNG): an affiliate of Gulf Landing LLC.

SIEP: Shell International Exploration and Production.

SIGTTO: Society of International Gas Tanker and Terminal Operators.

SMYS: specified minimum yield stress.

SNALGN: *see* Shell NA LNG LLC.

SO_2: sulfur dioxide.

SOI: Shell Oil International.

SPB: self-supportive Prismatic IMO-type B rectangular tank system for LNG storage.

SSDS: safety shutdown system.

STASCO: Shell International Trading and Shipping Company Limited.

TEMA: Test and Evaluation Management Agency.

terminal, the: see Gulf Landing terminal.

TLP: tension leg platform.

ton: short ton (2,000 pounds).

tonne: metric ton (2,204 pounds).

TPY: tons per year.

USC: United States Code.

UHF: ultra high frequency; from 300 megahertz (MHz) to 3,000 MHz.

UL: Underwriters Laboratories, Inc.

ULCC: ultra large crude carriers.

UPS: uninterruptible power supply.

USACE: United States Army Corps of Engineers.

USC: United States Code.

USCG: United States Coast Guard.

U. S. Coast Guard: United States Coast Guard

USEPA: United States Environmental Protection Agency.

V: volts.

VHF: very high frequency; from 30 MHz to 300 MHz.

VLCC: very large crude carriers.

VOC: volatile organic compound.

WAN: *see* wide area network.

WC 213: Block 213 in the West Cameron Area of the Gulf of Mexico.

WC 214: Block 214 of the West Cameron Area in the Gulf of Mexico.

WHRU: waste heat recovery unit.

wide area network (WAN): A system of local area networks (LANs) interconnected over distance via telephone lines or radio waves.

1 Introduction

Part 148

Overview

Gulf Landing LLC (“Applicant” or “Gulf Landing”), a Delaware limited liability company, is filing an application for a license pursuant to the Deepwater Port Act of 1974, as amended (DWPA), to construct, own, and operate a deepwater port (hereinafter referred to as “the Gulf Landing terminal” or “the terminal”) to be used for the receipt, storage, regasification, and delivery of liquefied natural gas (LNG). As more fully described within this application, the terminal will serve as an LNG receiving, storage, and regasification facility that can accommodate various LNG carrier configurations. The terminal is designed to store up to 180,000 cubic meters (m^3) net of LNG and send out approximately 1 billion cubic feet per day (Bcfd) of natural gas on average with a peak daily send-out rate of up to 1.2 Bcfd. Assuming average day operations, the terminal is expected to receive and vaporize approximately 7.7 million tonnes (metric tons) of LNG on an annual basis.

The terminal will be located approximately 38 miles (61 kilometers [km]) offshore Louisiana in Block 213 of the West Cameron Area (WC 213) in the Gulf of Mexico (GoM) in water depth of approximately 55 feet (ft; 16.8 meters [m]). The terminal will consist of two concrete gravity base structures (GBSs) housing the LNG containment facilities along with topside unloading and vaporization structures, living quarters and a ship berthing system. The terminal will include pipeline interconnections with up to five (5) existing offshore natural gas pipelines that will receive the regasified LNG and transport the gas onshore for delivery into the existing onshore natural gas pipeline grid for provision to consumers. Shell NA LNG LLC (SNALNG), an affiliate of Gulf Landing, will hold 100% of the capacity of the terminal.

Gulf Landing is seeking a deepwater port license at this time to accommodate the country’s growing need for infrastructure to accommodate new sources of imported LNG. As amply stated within the Energy Information Agency’s *2003 Energy Outlook*, in coming years LNG is expected to play a greater role in providing natural gas to the nation as domestic production declines. The Gulf Landing terminal is being proposed with several principles in mind, including but not limited to:

- Natural gas is a clean-burning and environmentally friendly fuel whose utilization has been encouraged by the last three Administrations;
- Taking advantage of an existing network of offshore natural gas pipelines in order to minimize the environmental impact of laying new pipelines to shore and increasing the utilization of this existing pipeline network;

- Minimizing the environmental impact and shipping congestion at onshore locations by constructing a terminal offshore; and,
- Locating the terminal adjacent to an existing shipping fairway to minimize the impact to future development of offshore resources.

Construction and testing of the facilities is estimated to take approximately three and one-half (3.5) years from construction start to the in-service date. Applicant is targeting an in-service date of January 2009. The terminal will have an expected service life of at least thirty (30) years.

2 148.105 Elements of the Application

The contents of this deepwater port license application are arranged in the same order as Section 148.105 of the United States Coast Guard's (U.S. Coast Guard's) Regulations (proposed) as presented in the "Notice of Proposed Rulemaking" published in the *Federal Register*[1] on May 30, 2002. Although the table of contents and the body of this application are arranged numerically, each subheading directly relates to an informational requirement addressed in Proposed Section 148.105. It must be noted that the proposed regulations, being followed herein, were issued by the U.S. Coast Guard prior to the amendment of the DWPA that provided for natural gas deepwater ports[2].

In this regard, some application requirements for oil do not directly translate to natural gas on a one-to-one basis, or are not applicable. For instance, Proposed Section 148.105(g) includes an informational item referred to as "runs to stills." Gulf Landing is unaware of a comparable activity as it relates to natural gas. Thus, Gulf Landing has made a good faith effort to provide information that it believes addresses the spirit and intent of the proposed regulations as they pertain to natural gas; application requirements for oil that are not applicable to natural gas have been noted as such.

Gulf Landing will supplement this application if it subsequently discovers an omission due to an error in interpretation.

2.1 148.105(a) Identities of the Applicant and its Affiliate(s)

2.1.1 148.105(a)(1), (2), and (4) Applicant

The applicant for this license is Gulf Landing LLC, a limited liability company formed in and under the laws of the State of Delaware. Applicant's principal business activity will be the construction, ownership, and operation of the Gulf Landing terminal. Applicant's address and phone number are:

[1] *FR*, Vol. 67, No. 104 [37920-37963].
[2] On November 13, 2002, the Maritime Transportation Security Act of 2002 was signed into law. Among other things, this act amended the DWPA to include natural gas, which is defined to include LNG.

Gulf Landing LLC
1301 McKinney
Suite 700
Houston, Texas 77010
Phone: (713) 230-3708

The Applicant's officers and directors are:

Directors

A.Y. Noojin, III	Chairman of the Board
L.B.D. Strebel	Director

Officers

A.Y. Noojin, III	President
W.T. Mooney	Vice President-Tax
S. Noordegraaf	Chief Financial Officer, Vice President, and Treasurer
S.J. Paul	Secretary
W.G. Hougland	Assistant Secretary

All officers and directors of Gulf Landing are United States citizens, except the Chief Financial Officer.

2.1.2
148.105(a)(3)
Description and Ownership Interest of Affiliate(s)

Applicant is a wholly owned subsidiary of Shell US Gas & Power LLC, a Delaware limited liability company. Shell US Gas & Power LLC is a wholly owned indirect subsidiary of Shell Oil Company, a Delaware corporation. Shell Oil Company, its consolidated subsidiary companies and companies in which Shell Oil Company owns equity interests (collectively "Shell Oil"), is one of the leading oil and natural gas producers, natural gas marketers, gasoline marketers, and petrochemical manufacturers in the United States. Shell Oil Company is part of the Royal Dutch/Shell Group of Companies.

The Royal Dutch/Shell Group of Companies grew out of an alliance made in 1907 between Royal Dutch Petroleum Company and The "Shell" Transport and Trading Company, p.l.c., (the "Parent Companies"). The two companies agreed to merge their interests on a 60:40 basis while keeping their separate identities.

Each Parent Company is a public company whose shares are publicly traded. The Parent Companies do not engage directly in operational activities. All operational activities are carried out by Group companies, such as Shell Oil Company, Shell US Gas & Power LLC, and Gulf Landing LLC. The companies that comprise the Group are separate and independent legal entities with their own boards of directors, or equivalent governing bodies, and their own management.

The Royal Dutch/Shell Group of Companies (Shell Group) is a world leader in natural gas with operations spanning the breadth of the gas industry, including LNG, shipping, receiving terminals, gas pipeline transmission, and marketing and trading. Recent annual reports of the Royal Dutch/Shell

Parent Companies can be accessed at *www.shell.com*. The term Shell, as used herein, refers to one or more entities in the Shell Group, as the context requires.

2.1.3
148.105(a)(5)
Five-Year History

Gulf Landing LLC, formerly known as Tejas Midstream Enterprises LLC, formerly known as Shell Midstream Holdings LLC, is a limited liability company formed in the State of Delaware on January 7, 1998. The company changed its name to Gulf Landing LLC on March 18, 2003. It is authorized to do business in the states of Texas and Louisiana. Copies of the Limited Liability Company Agreement, Certificate of Formation, and related documents are provided in Appendix A. Gulf Landing LLC and its predecessors in interest have never filed for protection under bankruptcy or similar laws. There is no pending litigation or governmental investigation against Gulf Landing LLC.

2.1.4
148.105(a)(6)
Lobbying Activities, 31 USC 1352

The provisions of 31 United States Code (USC) Section 1352 are inapplicable because this application does not involve the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, or the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2.2
148.105(b)
Experience Related to Deepwater Ports

This section contains information regarding experience relating to LNG and deepwater ports. As Gulf Landing is a limited purpose company, this section draws on information about and the experience of Shell.

2.2.1
148.105(b)(1)
Offshore Operations Experience

Applicant is a limited-purpose company established to own and operate the Gulf Landing terminal. Gulf Landing is and will continue to draw upon the worldwide resources of Shell in order to provide the necessary expertise and experience during all stages of design, construction, installation, and operation of the facility. Shell has extensive experience in the oil and gas industry, both onshore and offshore, in a global capacity. However, in the United States, Shell is particularly recognized for its developments in the GoM. For many years, Shell has been the leading deepwater GoM producer in terms of volume, water depth, technology, and safety. Shell is a part owner of the Louisiana Offshore Oil Port (LOOP), the only deepwater port presently in operation in the United States.

Shell has five core business sectors, encompassing:

- **Exploration and Production.** Searches for, finds, and produces oil and gas; builds the infrastructure needed to deliver hydrocarbons to market.
- **Gas & Power.** Commercializes natural gas, supplies liquefied natural gas, develops markets and infrastructures for and markets and trades natural gas and electricity, develops power plants, and converts gas to liquids.
- **Oil Products.** Sells, markets, and transports fuels, lubricants and specialty petroleum products; refines, supplies, trades, and ships crude oil and petroleum products; provides consultancy services to third parties based on Shell technology and experience gained in Shell operations.
- **Chemicals.** Produces and sells base chemicals, petrochemical building blocks, and polyolefins globally.
- **Renewables.** Generates 'green' electricity and provides renewable energy solutions; develops and operates wind farms, manufactures and markets solar systems, and grows sustainably managed forests.

Shell has been a pioneer of the gas industry for more than 30 years and is one of the largest equity producers of natural gas worldwide. Shell's Gas & Power business stretches across 27 countries, with developing activities in an additional 18 countries. Most operations are joint ventures with governments, or local and international co-venturers. Shell provides the technical and operational leadership for many of the joint venture projects.

All companies in Shell share a strong commitment to sustainable development. In practice, this means balancing the three elements of economic, environmental, and social performance. This approach allows long-term projects to operate harmoniously in local communities with the support of national governments.

Deepwater Ports

Shell is a part owner of LOOP LLC, operator of the Louisiana Offshore Oil Port. In this role, Shell has a responsibility for the port activities and Shell staff have actively participated in the management of the facility.

LOOP LLC is a limited liability company whose primary business is offloading foreign crude oil from tankers, storing crude oil, and transporting crude oil via connecting pipelines to refineries throughout the Gulf Coast and Midwest. The company was organized in 1972 as a Delaware corporation and converted to a limited liability company in 1996. Ashland Inc., Marathon Ashland Pipe Line LLC, Murphy Oil Corporation, Shell Oil Company, and Texaco Inc. are LOOP's owners.

The port facility is located in the Gulf of Mexico, 18 miles south of Grand Isle, Louisiana, in 110 feet of water. LOOP is the only port in the U.S. capable of offloading deep draft tankers known as ultra large crude carriers (ULCC) and very large crude carriers (VLCC). Along with offloading crude from VLCCs, LOOP also offloads smaller tankers. The port has been in commercial operation since 1981.

LNG Technology

LNG is produced when natural gas is cooled to a cold, colorless liquid at -160 degrees Celsius (°C; -256 degrees Fahrenheit [°F]). Once liquefied, the LNG can be transported by ship to markets further than would be practical with pipelines. This technology allows customers who live or operate a long way from gas reserves to enjoy the benefits of this clean fuel. Shell is the world's leading private provider in the LNG business, with equity sales of more than 8 million tonnes a year.

Shell has been a leader in developing LNG technology since the late 1950s. Shell led the design and brought to commercial operation the LNG plant in Brunei in 1972, in Malaysia in 1983, and in Australia's North West Shelf in 1989. A second LNG plant in Malaysia started operation in 1995. Unique challenges were overcome in Nigeria to bring the LNG plant located at Bonny Island on stream in 1999. During this time, Shell developed improved lower cost technology and designs, resulting in the Oman LNG plant startup in 2000 with the lowest ever unit cost of production.

In all these projects, Shell played a leading role in all aspects of the LNG supply process – as technical advisers to all the above LNG plants and by providing international staff and experience to assist local employees in their operation. Shell has extensive commercial experience in developing new LNG projects, negotiating the contracts, and bringing the ideas into reality. Shell provides a full shipping operation and management service for LNG transport. Shell's international financial expertise helps to bring the sound commercial and technical basis into a financeable package.

Additional information on LNG is contained in the brochure entitled “Liquefied Natural Gas” provided in Appendix B.

LNG Shipping

Shipment of LNG, a hydrocarbon at -160°C (-256°F), is a highly specialized business. Through its vast experience as one of the largest LNG ship operators in the world, Shell has played a leading role in making LNG one of the safest of any shipping operation.

Shell, through its company STASCO, provides a full range of LNG shipping services. These include fleet management, manning and operation, and providing technical and operational advice. Considering all these elements, Shell covers about one quarter of all worldwide LNG shipping operations.

Shell provides full shipping coverage from the day the shipping need is identified. It advises on:

- Fleet configuration and ship design requirements;
- Ship tendering, tender evaluations, and financing;
- Working with the shipyard to ensure that the ship is built to specification;
- Ship commissioning, operation, maintenance, dry-docking, etc.; and
- Ship life-extension studies as the life of the ship progresses.

Shell is involved in the operation of 25 LNG ships around the world.

- **Brunei.** Shell is a shareholder in Brunei Shell Tankers and is responsible for management and manning of the eight-ship fleet.

- **Malaysia.** For Malaysia LNG Satu and Malaysia LNG Dua, Shell provides manning services to the LNG ship operator.
- **Australia.** For the North West Shelf Project, Shell manages and provides manning for one of the LNG carriers, has a one-sixth shareholding in six and, in partnership with others, owns the operating company that operates four of the ships. Shell also provides technical advice along with the other venture partners to the fleet management company.
- **Nigeria.** Shell is a shareholder in Bonny Gas Transport. Shell manages four vessels owned by Nigeria LNG. A fifth vessel, currently on charter, is also managed by Shell.
- **Oman.** Shell provides shipping advice to Oman LNG.

Additional information on LNG Shipping is contained in the brochure titled “LNG Shipping” contained in Appendix C.

LNG Receiving Terminals

Once shipped, LNG must be delivered to a receiving terminal, stored, re-vaporized, and sent in gaseous form by pipeline to market centers. Shell is applying its skills in LNG technology with its commercial, financial, and managerial strengths to develop new terminals and bring the benefits of LNG to new markets.

Shell has extensive design experience in the key elements of receiving terminals, which mirror the same elements of supply plants. Common design and operating requirements exist from the shipping marine conditions of the port; to the jetty and LNG transfer systems; to the cryogenic piping to the LNG storage tanks; to the LNG pumps and transfer systems; to the vapor recovery compression systems. Shell is presently building the Hazira LNG import terminal in Gujarat, North West India; has a stake in an operational LNG import terminal in Zeebrugge, Belgium; and has secured capacity at Cove Point, Maryland, and Elba Island, Georgia in the United States. Additionally, Shell has an interface with almost all LNG terminals in the world because it requires a thorough safety and compatibility check of LNG terminals before Shell-operated ships can discharge there. Also, from many years of operation, Shell has a close, long-term association with buyers’ terminals and their people.

The introduction of LNG to new countries such as India takes many years, and Shell has been able to draw on its experience and skills to overcome the special challenges where existing gas infrastructure is minimal. These cover not only the usual site location and technical aspects but also gas marketing needs, the ability to present a viable economic proposal competitive with alternate energy sources, and the special financing requirements.

Additional information on LNG receiving terminals is contained in the brochure titled “LNG Receiving Terminals” contained in Appendix D.

Pipeline Gas Transmission

Gas is transported by pipeline from the LNG receiving terminal to the markets. Shell is a major player in pipeline gas transport in Europe, the Americas, and several other countries, owning interest in many such gas pipeline transmission systems where, as with almost all Shell’s gas interests, individual operations are conducted with joint venture partners. In Europe, the main holdings are in Gasunie of the Netherlands, BEB and Thyssengas in Germany, and Distrigaz in Belgium. To varying degrees, Shell is technical and commercial adviser to all these companies and provides expert staff to assist operations. In the United States, Shell US Gas & Power LLC has substantial gas pipeline interests, including the offshore pipeline operations of Shell Gas Transmission through which Shell's substantial GoM reserves are being gathered and transported.

Other interests in gas transmission are held in ventures, with locations that include Bolivia, Brazil, Egypt, and Syria. Additional information on pipeline gas transmission is contained in the brochure titled "Gas Pipelines" contained in Appendix E.

Offshore Operations

Shell is one of the largest oil and gas producers in the GoM and has extensive operating experience in both shallow and deepwater areas. Shell was a pioneer of deepwater (more than 1,500 ft [457 m]) oil and gas production in the GoM. Shell's giant tension leg platforms (TLPs) were the first deepwater production hubs.

Four Shell TLPs set world depth records at the time they were installed. The Auger TLP was first in 1994, followed by Mars, Ram-Powell, and Ursa. Today, these production platforms serve as hubs for surrounding deepwater fields. Brutus, the newest TLP, began production in August 2001. As discoveries have moved further offshore in deeper waters, Shell's technical community has pioneered innovative subsea technology that allows economic production from remote fields with minimal environmental footprints.

The wells of the Mensa subsea development lie on the GoM floor 5,300 ft (1,615 m) below the water's surface. These wells tie back to a shallow water platform via 68 miles (109 km) of flow line, the world's longest tieback.

Shell companies have operatorship in 15 countries offshore and 14 countries onshore. Shell is one of the largest gas producers in the world and Shell's operated oil production represents about 6% of the world's daily energy demand.

A partial list of Shell-operated properties in the GoM is provided in Table 2-1.

Table 2-1
Shell Oil Deepwater Gulf of Mexico Ventures

Project Name	Production	Production Technology	Water Depth (Feet)	Anticipated Peak Daily Capacity	Shell Working Interest Ownership
Auger/Cardamom	1994	Tension-leg platform	2,860	100,000 bopd 410 MMscfd	100%
Tahoe	1994	Subsea	1,500	300 MMscfd	70%
Southeast Tahoe	1996	Subsea	1,770	Included in Tahoe	100%
Popeye	1996	Subsea	2,100	160 MMscfd	37.5%
Green Canyon Block 110	1996	Subsea	1,730	6,900 bopd	100%
Mars	1996	Tension-leg platform	2,940	200,000 bopd 200 MMscfd	71.5%

Table 2-1
Shell Oil Deepwater Gulf of Mexico Ventures

Project Name	Production	Production Technology	Water Depth (Feet)	Anticipated Peak Daily Capacity	Shell Working Interest Ownership
Ram/Powell	1997	Tension-leg platform	3,214	60,000 bopd 290 MMscfd	38%
Mensa	1997	Subsea	5,300	300 MMscfd	100%
Troika	1997	Subsea	2,800	80,000 bopd 140 MMscfd	33.3%
Ursa	1999	Tension-leg platform	3,800	150,000 bopd 400 MMscfd	45.4%
Marlin	1999	Tension-leg platform	3,200	40,000 bopd 250 MMscfd	18.9%
Macaroni	1999	Subsea	3,700	60,000 bopd 45 MMscfd	51%
Angus	1999	Subsea	2,000	40,000 bopd 60 MMscfd	51.6%
Europa	2000	Subsea	3,900	60,000 bopd 45 MMscfd	34%
King	2000	Subsea	3,285	5,000 to 15,000 bopd	33.3%
Brutus	2001	Tension-leg platform	2,985	100,000 bopd 150 MMscfd	100%
Serrano	2001	Subsea	3,400	150 MMscfd	100%
Oregano	2001	Subsea	3,400	20,000 bopd	100%
Crosby	2001	Subsea	4,400	60,000 bopd 90 MMscfd	50%
Na Kika	2003	Subsea wells with semi-submersible platform	5,800 to 7,000	100,000 bopd 325 MMscfd	50%
Coulomb	2005	Subsea	7,600	90 MMscfd	100%

Key:
bopd = Barrels of oil per day.
MMscfd = Million standard cubic feet per day.

2.2.2
148.105(b)(2)
Contracted Affiliates' Marine and Offshore Construction Experience and Qualifications

Shell has extensive experience in the construction of many types of marine and offshore facilities. Over the last eight years, Shell has successfully designed, built, and installed a series of five deepwater tension leg platforms in the GoM. These projects are among the most recognizable in the industry today (see Table 2-2). This continues with the construction of the Na Kika semi-submersible floating production unit presently being installed in the GoM.

Over the years, Shell has built several concrete GBSs, including the Brent Bravo, Brent Charlie, Brent Delta, Dunlin, and Cormorant platforms all built in the mid to late 1970s in the UK North Sea, the Nam F3 platform offshore The Netherlands in 1992, the Draugen platform offshore Norway in 1993, and the Troll platform also offshore Norway in 1995. Several of these concrete GBSs have been in reliable service in the harsh environment of the North Sea for over 25 years.

In 2002, Shell installed the Malampaya gravity base platform offshore The Philippines. This steel reinforced concrete structure is used for processing natural gas and storing liquid condensate. Shell is in the final stages of the construction of Floating Production, Storage and Offloading (FPSO) units for the Bonga Field Offshore Nigeria and the Bijupira / Salema Fields offshore Brazil. Shell is in the process of building four new LNG carriers. These additions to its LNG carrier fleet are entering service in 2003 and 2004.

Table 2-2
Marine and Offshore Construction Experience

Name	Year	Type	Description
Brent Bravo	1975	Concrete GBS	140 m water depth
Brent Charlie	1976	Concrete GBS	140 m water depth
Brent Delta	1976	Concrete GBS	140 m water depth
Dunlin	1978	Concrete GBS	151 m water depth
Cormorant	1982	Concrete GBS	161 m water depth
Draugen	1993	Concrete GBS	251 m water depth
Nam F3	1992	Concrete GBS	42 m water depth
Auger	1994	TLP	871 m water depth
Troll	1995	Concrete GBS	303 m water depth
Mars	1996	TLP	896 m water depth
Ram/Powell	1997	TLP	979 m water depth
Ursa	1997	TLP	1,158 m water depth
Brutus	1999	TLP	975 m water depth
Na Kika	2001	Semi Submersible FPS	1,768 m water depth
Galea series	2003	LNG Carriers	135,000 cubic meters

Table 2-2
Marine and Offshore Construction Experience

Name	Year	Type	Description
Malampaya	2002	Concrete GBS	43 m water depth
Bonga	2003	FPSO	1,200 m water depth
Bijupira/Salema	2003	FPSO	700 m water depth

Key:
FPS = Floating production system.
FPSO = Floating, production, storage, and offloading.
GBS = Gravity base structure.
LNG = Liquid natural gas.
m = Meter.
TLP = Tension leg platform.

2.3
148.105(c)
Engineering Firm(s)

The identities of engineering firms currently involved in the technical work supporting the license application are listed in Table 2-3. The project experience of the various firms is described in the data sheets provided in the sub-attachments to Attachment A {*confidential*}. As work on the detailed design of the terminal proceeds, additional engineering firms may be identified. Applicant will provide information on such additional engineering firms to the Commandant [G-M] U.S. Coast Guard in Washington, D.C. at that time.

Table 2-3
Identity of Each Engineering Firm

Name	Address	Citizenship	Telephone number	Qualifications
Delta Marine Consultants bv (DMC)	H.J. Nederhorststraat 1 P.O. Box 268 2800 AG Gouda The Netherlands	The Netherlands	+ 31 182 59 06 00	Attachment A-1
Maritime Research Institute Netherlands (MARIN)	Haagsteeg 2, 6702 PM, Wageningen The Netherlands	The Netherlands	+31 317 49 39 11	Attachment A-2
Alkyon Hydraulic Consultancy & Research B.V.	PO Box 248 8300 AE Emmeloord Marknesse The Netherlands	The Netherlands	+31 527 24 81 00	Attachment A-3
DHI – Water & Environment	Agern Alle 5 DK-2970 Hoersholm Denmark	Denmark	+45 45 16 92 00	Attachment A-4

Table 2-3
Identity of Each Engineering Firm

Name	Address	Citizenship	Telephone number	Qualifications
Societe Nouvelle TECHNIGAZ	1/7 Avenue San Fernando 78884 Saint-Quentin-Yvelines Cedex, France	France	+33 1 61 37 89 73	Attachment A-5
Ove Arup & Parnters Ltd.	13 Fitzroy Street London W1T 4BQ UK	United Kingdom	+44 20 7636-1531	Attachment A-6
C&C Technologies, Inc.	700 Kaliste Saloom Rd. Lafayette, LA 70508 USA	United States	(337) 261-0600	Attachment A-7
Fugro-McClelland Marine Geosciences, Inc.	6100 Hillcroft Drive Suite 400 Houston TX 77081 USA	United States	(713) 369-5552	Attachment A-8
Continental Shelf Associates, Inc. (CSA)	759 Parkway Street Jupiter FL 33477 USA	United States	(561) 746-7946	Attachment A-9
Ecology & Environment, Inc. (E & E)	368 Pleasantview Drive Lancaster, NY 14086 USA	United States	(716) 684-8060	Attachment A-10
Waldemar S. Nelson and Co. Inc.	1200 St. Charles Ave. New Orleans, LA 70130 USA	United States	(504) 523-5281	Attachment A-11
W. H. Linder & Associates, Inc.	3330 W. Esplanade Ave. New Orleans, LA 70002 USA	United States	(504) 835-2577	Attachment A-12

2.4
148.105(d)
Applicant's Citizenship, Incorporation, and Authority

Applicant is a limited liability company formed in and under the laws of the State of Delaware, United States of America. Pursuant to the requirements of this section, copies of Applicant's limited liability company agreement and related documents which includes its Certificate of Formation and related amendments are included in Appendix A of this application. All officers and directors of Gulf Landing are United States citizens, except the Chief Financial Officer.

2.5 148.105(e) Contact for Service of Documents

The names, titles, and mailing addresses of persons to whom correspondence and communications concerning this application should be directed are as follows:

Primary Contact for Legal Service:

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Senior Counsel, Gas & Power Legal
Shell Oil Company
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1301 McKinney
Houston, TX 77010
Phone: (713) 230-1717
Fax: (713) 230-1718
Email: Kathleen.Puckett@shell.com

Primary Contact for Non-Legal Service:

Larry D. Jensen
Manager Regulatory
Shell US Gas & Power
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1301 McKinney
Houston, Texas 77010
Phone: (713) 230-3134
Fax: (713) 265-3134
Email: ljensen@shell-gt.com

Additional Contacts:

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Gulf Landing Project Manager
Shell International Exploration & Production
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Phone: (281) 544-3370
Fax: (281) 544-2415
Email: Denby.Morrison@shell.com

William H. Daughdrill
Principal Environmental Scientist
Ecology & Environment, Inc.
11550 Newcastle Avenue
Baton Rouge, LA 70816
Phone: (225) 298-5094
Fax: (225) 298-5081
Email: wdaughdrill@ene.com

2.6 148.105(f) Proposed Location and Use of Deepwater Port

The terminal will be located in WC 213 in the GoM. This location is approximately 38 miles (61 km) south of the coast of Louisiana, in approximately 55 ft (16.8 m) water depth. The location of the terminal is shown on Figure 2-1. The general layout of the terminal is shown on Figure 2-2. LNG carriers will need to traverse the western portion of West Cameron Block 214 (WC 214) for ingress to and egress from the terminal.

The terminal consists of two concrete GBSs with integral LNG storage tanks, LNG carrier berthing provisions, LNG unloading arms, high-pressure pumps, vaporizers, sales gas heaters, fiscal meters, utility systems, general facilities and accommodations. The terminal will be designed to handle a nominal capacity of 7.7 million tonnes per year of LNG. This equates to a nominal vaporization capacity of 1 Bcfd. The vaporization facilities will be designed for a peak capacity of 1.2 Bcfd to provide additional supply during periods of peak demand.

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Figure 2-1
Site Map for Gulf Landing Terminal

Figure 2-2□
Terminal General Layout

The terminal provides seven basic functions:

- LNG carrier berthing;
- LNG carrier unloading;
- LNG storage;
- LNG vaporization;
- Gas metering and delivery;
- Power generation; and
- Personnel quarters.

Additional details related to these functions are provided in Section 2.17.1 "Fixed Offshore Component Descriptions and Design Drawings."

LNG Berthing

The terminal will be capable of berthing standard worldwide trading LNG carriers of either the membrane or spherical design. The size range of LNG carriers that the terminal can accommodate will be from 786,000 to 1,006,000 barrels (bbls; 125,000 to 160,000 m^3). Berthing will be accomplished with the aid of tugs. The facility will be operated in a continuous mode and will be designed to accommodate the arrival, unloading, and departure of the LNG carriers. Applicant anticipates unloading approximately 135 LNG carriers per year with the LNG supply sourced from several locations. The arrangement of the berthing area, mooring locations, new send-out pipelines, and LNG carrier traffic pattern is shown on Drawing Number 03-003-1033 in Attachment D {*confidential*}.

LNG Carrier Unloading

LNG carriers will berth directly alongside the Gulf Landing terminal to unload. The terminal will be equipped with fenders and quick release hooks to facilitate mooring operations. Unloading will be side-by-side using unloading arms located on the eastern GBS. The design unloading rate of the terminal is up to 1,812,000 barrels per day (bpd; 12,000 m^3/h). A small flow of LNG recirculation will be required from downstream of the unloading arms to the storage tank to keep the LNG system "cold," (i.e., "ready for service" to avoid thermal shock between carrier unloading cycles). LNG custody transfer measurement between ship and terminal will follow normal industry practice and take place on the LNG carrier.

LNG Storage

The LNG will be stored in tanks located and supported inside the two concrete GBSs. Each of the box sections contains a separate LNG storage tank. The net storage capacity of each tank will be 566,000 bbl (90,000 m^3) providing a total net storage capacity of 1,132,000 bbl (180,000 m^3). The gross storage capacity of each tank is approximately 629,000 bbl (100,000 m^3) providing a total gross storage capacity of approximately 1,258,000 bbl (200,000 m^3). This gross volume provides an excess above the net useable storage volume to ensure adequate safety margins and to meet operational requirements. The LNG containment system may be of the self-supporting prismatic International Maritime Organization (IMO)-type B (SPB) rectangular tank system, the 9% nickel-steel cylindrical tank system, the membrane tank system; either cylindrical or rectangular, or any other acceptable containment system.

LNG Vaporization

The deck of the concrete GBS will support the terminal processing and metering equipment. The vaporization equipment includes the LNG low-pressure in-tank pumps, high-pressure pumps, vaporizers, seawater intake pumps, and sales gas heaters.

The LNG will arrive on the facilities from the LNG carrier and unloading area where it will be pumped into the terminal storage tanks. From here, the LNG will be pumped to the process facilities using low-pressure in-tank pumps. High-pressure pumps pump the LNG to a pressure of up to 1,450 pounds per square inch (psi; 100 bar), which is at or above the required natural gas send-out pressure. The LNG will be vaporized via open-rack vaporizers (ORVs) to natural gas ready for metering and transportation. Seawater will be the ORV heating medium for the LNG vaporization. The vaporized LNG will be metered and delivered to existing offshore natural gas pipelines via up to five interconnections that will be constructed as part of the terminal. The process flow schematic diagram of the terminal is shown on Figure 2-3. A cross sectional view of the terminal is shown on Figure 2-4 and the location of the seawater intakes and outfalls are shown on Figure 2-5.

Gas Metering and Delivery

The vaporized LNG will be metered and delivered into the offshore transportation grid using up to five lateral pipelines. Each of the five metering stations will consist of two to four 10-inch (0.25-m) nominal meter tubes to suit the lateral capacity. A spare meter tube and meter will be available on the platform for replacement purposes. The pipeline laterals will consist of various lengths of 16-inch (0.41-m) to 36-inch (0.91-m) outer diameter pipe dependent on the design capacity, pressure drop considerations, and length of pipeline to the interconnection point.

Power Generation

The terminal electrical power requirements of approximately 17 megawatts (MW) will be provided by two turbine generator sets. One spare generator set will be installed. Fuel for the turbines will be provided from vaporized LNG via a fuel gas system. Two of the turbines will be dual fuel, capable of burning diesel for terminal start-up.

Personnel Quarters

Personnel quarters will be located on the terminal with appropriate segregation and protection from LNG unloading, storage, pumping, vaporization, and metering equipment. The living quarters building will consist of individual deck levels for sleeping, galley and messing, recreation, control room and offices, equipment and communications control rooms, workshops and stores areas, helicopter reception, etc. It will provide fully self-contained accommodations for operations personnel, including occasional short-term accommodations for offshore maintenance and gas pipeline staff. The quarters capacity will be 60 persons. A helicopter deck, able to accommodate two helicopters, will be located above the quarters building.

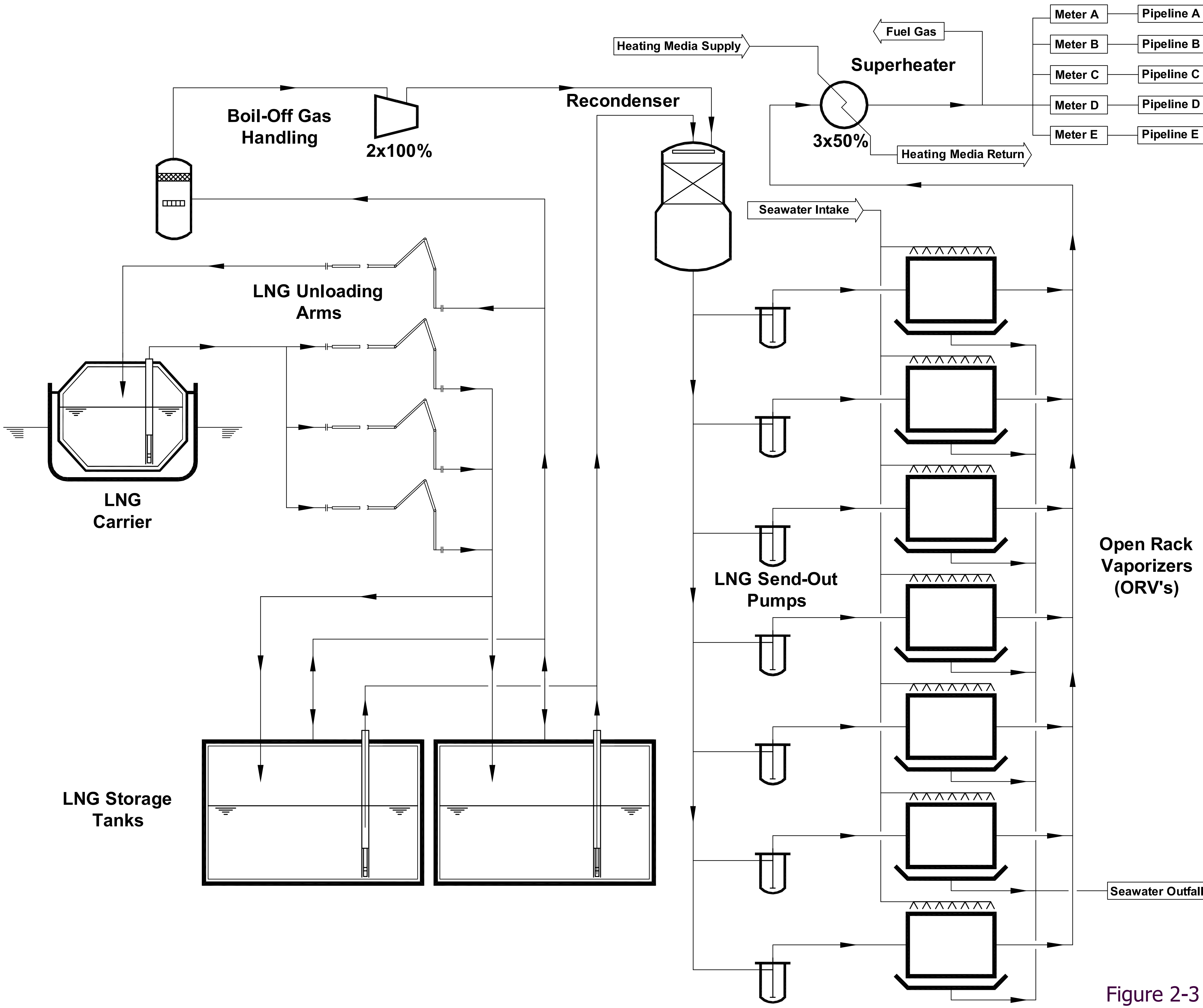

Figure 2-3 □
Process System Schematic Diagram

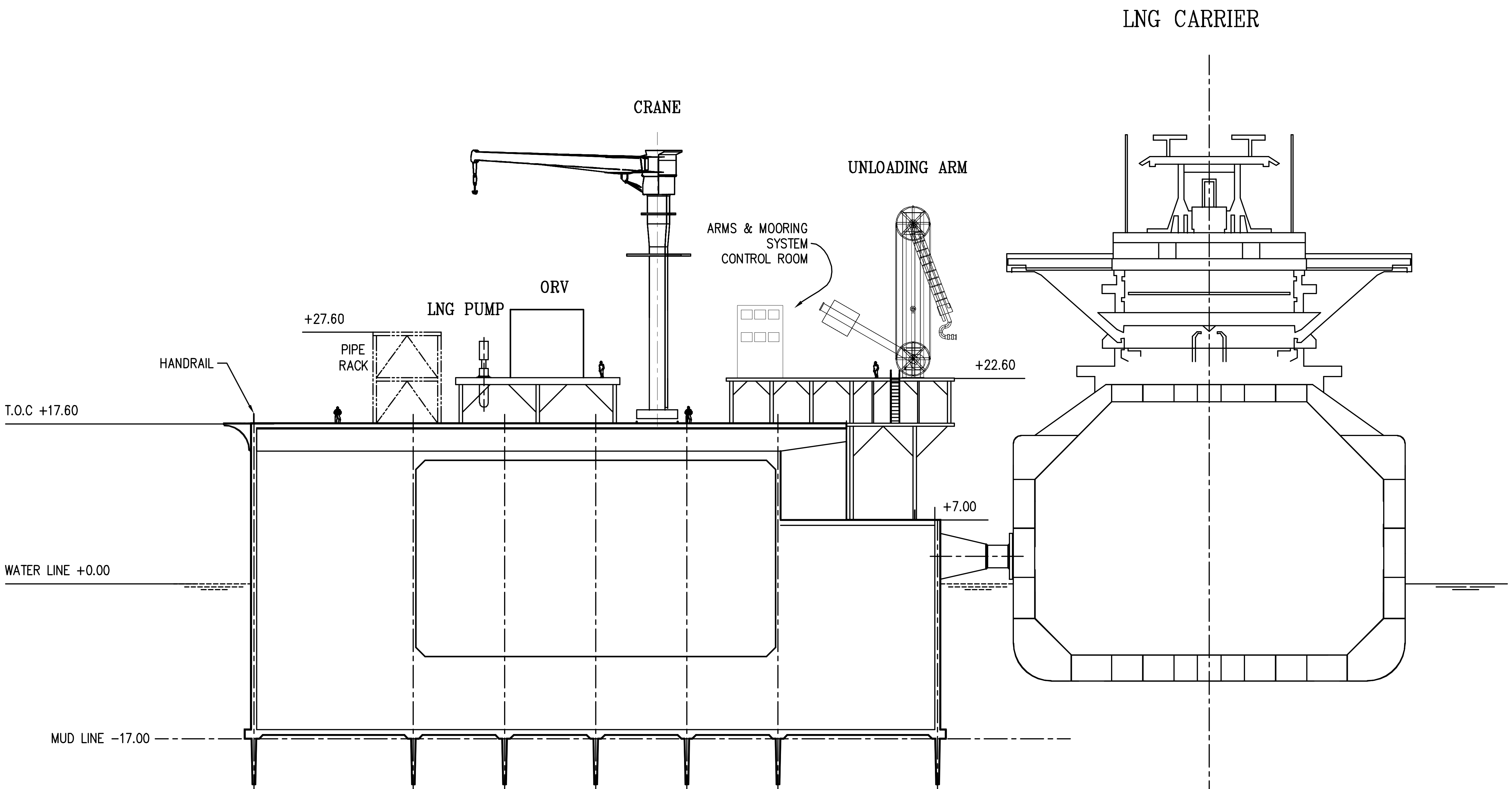

Figure 2-4 □
Terminal Cross Section

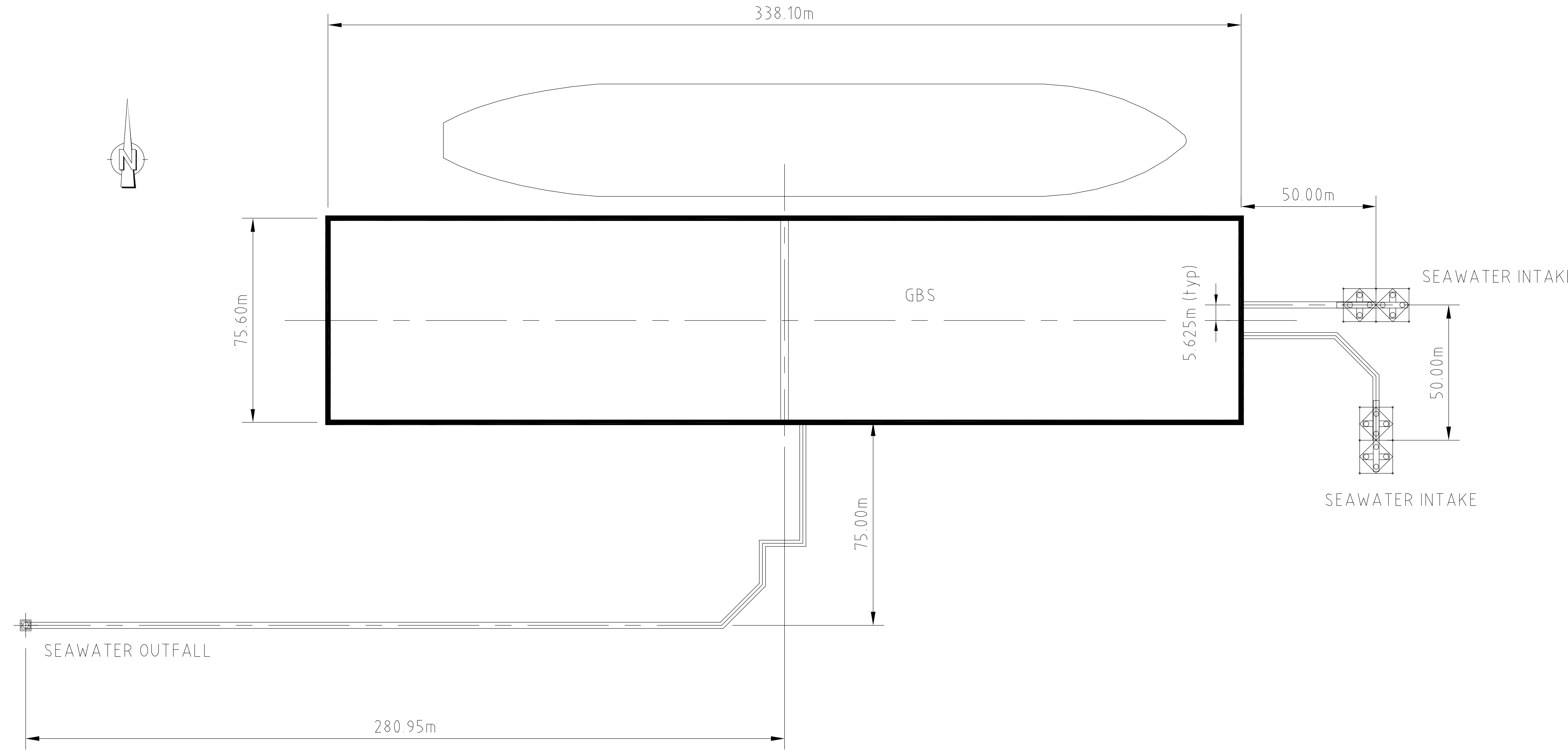

Figure 2-5 □
Seawater Intake and Outfall

2.7 148.105(g) Financial Information

2.7.1 148.105(g)(1) Applicant and Affiliate Financial Information

Financial information for the Applicant and Affiliates is contained in Volume IV of this application {*confidential*}. Volume IV includes balance sheets and income statements along with Applicants' future projections for the life of the terminal.

2.7.2 148.105(g)(2) Construction Cost Estimates

Installation of the terminal is scheduled for the 4th quarter of 2008 with first deliveries of LNG scheduled for January 2009. The estimated costs and completion dates for each phase of the project and information on removal costs are provided in Attachment B {*confidential*}.

2.7.3 148.105(g)(3) Future Projections

The starting point for the financial projections is the first year the terminal is expected to be in operation (i.e., 2009). The life of the terminal is expected to be at least 30 years. Projections are provided for the initial five years and at five-year intervals throughout the life of the terminal. The financial projections are based on an annual throughput of 7.7 million tonnes LNG. Financial projections including balance sheets and income statements are provided in Volume IV of this application {*confidential*}.

2.7.4 148.105(g)(4) Proposals and Agreements

Gulf Landing will own and operate the Gulf Landing terminal. The member-owner of Gulf Landing is Shell US Gas & Power LLC, a Delaware limited liability company that is indirectly owned 100% by Shell Oil Company, a Delaware corporation. Shell US Gas & Power LLC, through intra-corporate arrangements with Shell Oil Company, will have access to sufficient funds to make capital contributions to Gulf Landing necessary to fund construction of the Gulf Landing terminal and provide working capital to operate the terminal after completion of construction.

Shell NA LNG LLC, a Delaware limited liability company, will subscribe for 100% of the capacity of the terminal from Gulf Landing. The member-owner of Shell NA LNG LLC is also Shell US Gas & Power LLC. Shell US Gas & Power LLC, through intra-corporate arrangements with Shell Oil Company, will have access to sufficient funds to make capital contributions to Shell NA LNG LLC necessary to allow it to fund its payment obligations to Gulf Landing LLC for the capacity at the terminal.

2.7.5 148.105(g)(5) Anticipated Capacity, Runs to Stills, and Demand

Anticipated Capacity

The Gulf Landing terminal will receive carriers, store, and vaporize the LNG to a gaseous state for delivery into existing offshore pipeline systems. Storage capacity is designed to accommodate up to 180,000 m^3 net. The capacity of the vaporizers will allow a peak send-out of 1.2 Bcfd, although normal operations are expected to generate an average daily send-out of 1 Bcfd.

Runs to Stills

Runs to stills is not applicable to natural gas.

Demands

According to the Energy Information Administration (EIA),[1] demand for natural gas is expected to grow from current consumption levels. As detailed in the EIA's *Annual Energy Outlook 2003*,[2] demand from all customer classes and in all regions of the country are expected to increase through year 2025 under high and low economic growth cases. For instance, the natural gas share of electric power generation is expected to increase from 17% in 2001 to 29% in 2025.[3] This growth means that approximately 80% of electricity-generating capacity to be constructed between years 2001 and 2025 is expected to use natural gas as the source fuel using gas-fired combined-cycle or combustion turbine technology. In total, projections for U.S. domestic natural gas consumption in the year 2025 range from 31.8 trillion cubic feet (ft^3) in the low economic growth case to 37.5 trillion ft^3 in the high economic growth case. This compares to 22.6 trillion ft^3 consumed in 2001.[4]

The EIA projects that net imports of energy will be necessary to meet a growing share of this energy demand. Moreover, due to expected demand growth and the depletion of conventional natural gas resources in the lower 48 states, the EIA expects that the gas industry will become more reliant on new LNG facilities built to serve U.S. markets. In testimony presented before the Senate Energy and Natural Resources Committee on February 25, 2003, an EIA witness stated that LNG expansion will make up a good deal of the new supply needs, jumping from less than 1% of total U.S. supply today to about 6% by year 2025.

Natural gas is viewed as the environment-friendly fuel of choice. As a result, the last two U.S. Administrations and the current Administration have favored natural gas development and utilization over other carbon-based fuels. As the demand increases for natural gas, as discussed above, imported LNG is expected to meet an increasing share of the country's needs in future years. For this to occur, new infrastructure must be built to accommodate this growth. The Gulf Landing terminal is designed,

[1] The EIA is a statistical agency of the U.S. Department of Energy. Its mission includes providing policy-independent data, forecasts, and analyses to promote sound policy making, efficient markets, and public understanding regarding energy and its interaction with the economy and the environment.
[2] Energy Information Administration (EIA), 2003, United States Department of Energy, *Annual Energy Outlook 2003* with projections to 2025, Report No. DOE/EIA 0383(2003), Washington, D.C., http://www.eia.doe.gov/oiaf/aeo/.
[3] *ibid*.
[4] *ibid*.

not only to contribute to future LNG utilization, but also to take advantage of the existing offshore natural gas pipeline infrastructure to minimize any environmental impact to the greatest extent possible.

2.8 148.105(h) Construction Contract and Studies

This section provides information on the Applicants' intentions regarding construction contracts, information on the Applicants' potential contractors, and on various studies that have been performed.

2.8.1 148.105(h)(1) Construction and Operation Contracts

At this time, no contracts have been executed for the construction and operation of the terminal. It is not anticipated that contracts for construction and operation of the terminal will be executed until after approval of this license application. When construction and operations contracts are executed, which will occur subsequent to the issuance of a deepwater port license, copies will be made available to the Commandant [G-M] U.S. Coast Guard in Washington, D.C.

2.8.2 148.105(h)(2) Deepwater Port Studies Conducted for or by the Applicant

Studies related to the concept selection evaluation, engineering planning, and design approach for the terminal are listed in Attachment C {*confidential*}.

2.9 148.105(i) Compliance with Federal Water Pollution Requirements

2.9.1 148.105(i)(1) Federal Water Pollution Control Act Amendments of 1972

As directed by the DWPA, all deepwater ports must provide evidence that the project complies with the requirements of Section 401(a)(1) of the Federal Water Pollution Control Act Amendments of 1972 (also known as the Clean Water Act [CWA], 33 USC §1341(a)(1)).

The GBS graving dock associated with the Gulf Landing terminal may be constructed in U.S. jurisdictional waters and, if so, an application to address Section 401 permitting requirements will be made.

The terminal is required to meet the requirements of 33 CFR §158 - Reception Facilities For Oil, Noxious Liquid Substances, and Garbage as required by the International Convention for the

Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating to that Convention (International Convention for the Prevention of Pollution from Ships [MARPOL] 73/78). With regard to LNG carriers this relates primarily to the handling and approved disposal of oily residues from Machinery Space activities and garbage. This will be addressed during the detailed design phase of the project to ensure appropriate means are established to comply with the Regulations.

2.9.2
148.105(i)(2)
Request for Certification under 33 USC §1341(1)(1), if required

Pursuant to the State Water Quality Certification program of Section 401 of the CWA (33 USC §1341(a)(1)), an applicant obtaining a federal license or permit must provide certification that any discharges from the facility will comply with the act. Under these provisions, states have the authority to review any federal permit or license that may result in a discharge to wetlands and other waters under state jurisdiction, to ensure that the actions would be consistent with the state's water quality requirements and other applicable state laws. If the GBS graving dock is constructed in U.S. territorial waters, Gulf Landing will file the appropriate request for Water Quality Certification to the applicable state agency having jurisdiction for the construction site.

2.10
148.105(j)
Coastal Zone Management

The Gulf Landing terminal will be located approximately 38 miles (61 km) south of the Louisiana coast. Gulf Landing will construct and operate pipeline laterals to deliver vaporized LNG to existing offshore interstate natural gas pipelines.

All pipelines under consideration for interconnection with the Gulf Landing terminal are existing interstate pipelines that enter the state of Louisiana. Following the requirements of the DWPA, Louisiana will qualify as the "adjacent coastal state" for review of this application pursuant to the Coastal Zone Management Act (CZMA) of 1972, as amended (16 USC §1451 et seq.). Gulf Landing will submit a copy of this application to the State of Louisiana Coastal Management Division for the coastal consistency review.

Gulf Landing certifies that to the best of its knowledge, the proposed action described in this application complies with and will be conducted in a manner that is consistent with the Louisiana Coastal Management Program.

2.11 148.105(k) Lease Block Information

2.11.1 148.105(k)(1) Lease Block(s) where Proposed Deepwater Port or its Approaches are Located

The lease blocks where any parts of the proposed terminal or any of its approaches are located are shown in Drawing Number 03-003-1008 in Appendix F "Pipeline and Lease Block Information." The appendix includes the identification of each block lessee and the identification and lessee of each pipeline or other right-of-way crossing.

2.11.2 148.105(k)(2) Interest in Lease Block(s)

Information on the interest in each lease block, to the extent available, is contained in Appendix F.

2.11.3 148.105(k)(3) Present and Planned Use of Lease Block(s)

Information on the present and planned use of each lease block, to the extent available, is provided in Appendix F.

2.12 148.105(l) Overall Site Plan

This section provides information on the drawings and plans of the terminal.

2.12.1 148.105(l)(1) Floating Structures

No permanent floating structures are associated with the terminal.

2.12.2 148.105(l)(2) Fixed Structures

The general arrangement drawing series is listed in Table 2-4. These drawings illustrate the proposed terminal facility and are provided in Attachment D *{confidential}*.

Table 2-4
General Arrangement Drawing Series

Drawing No.	Title
T2-983-541	Equipment Layout Topsides
T-2.983.542	Equipment Layout Sections
T-2.983.543	Equipment Layout Elevation Following D-D
T-2.984.008	Intake/Outfall System and Scour Protection
03-003-1033	Marine Operations Plan with Ship Path Extension
03-003-7000	Location of Access/Egress Routes and Navaids

Note: Drawings provided in Attachment D *{confidential}*.

2.12.3
148.105(l)(3)
Aids to Navigation

In addition to general deck lighting, the GBSs will be equipped with navigation warning lights and aviation warning lights. The navigation warning lights will be provided as required by 33 Code of Federal Regulations (CFR) Part 149 Subpart E, Aids to Navigation. The locations of navigation warning lights are shown on Drawing Number 03-003-7000 contained in Attachment D {*confidential*}.

Aviation warning lights will be installed on the terminal vent tower and other tall structures (e.g., fixed cranes). These lights and their controller will meet all Federal Aviation Administration (FAA) and Federal Communications Commission (FCC) requirements. Alternating blue and yellow omni-directional taxiway lights will be installed to outline the heliport landing area.

Initially, the terminal will be fitted with twelve (12) obstruction lights arranged as shown on Drawing Number 03-003-7000 in Attachment D {*confidential*}. Each of the terminal's obstruction lights will be an assembly consisting of one or more marine lanterns that will meet the intensity, flash interval, and vertical divergence requirements of 33 CFR § 149.521 through § 149.527, respectively. Each fixed structure obstruction light will be installed approximately 75 ft (23 m) above mean water level. The location of the seawater outfall structure will be marked using a lighted isolated danger buoy.

2.12.4
148.105(l)(4)
Manifold Systems

The schematic diagram drawing series listed in Table 2-5 and provided in Attachment E {*confidential*} illustrates the type and process flow of the unloading, storage, vaporization, metering and utilities equipment on the terminal.

Table 2-5
Schematic Diagram Drawing Series

Drawing No.	Title
T-2.983.544	Process Flow Scheme
T-2.983.545	Unloading Area
T-2.983.546	LNG Storage Tank
T-2.983.547	Boil-off gas (BOG) Compressor
T-2.983.548	Recondenser
T-2.983.549	LNG HP Pumps
T-2.983.550	Open Rack Vaporizers
T-2.983.551	Metering Area
T-2.983.552	Flare / Vent
T-2.983.553	Instrument Air System
T-2.983.554	Fuel Gas System
T-2.983.555	Diesel Supply
T-2.983.556	Nitrogen Supply
T-2.983.557	Power Generation System
T-2.983.558	Fresh / Potable / Water System
T-2.983.559	Seawater Lift Pumps
T-2.983.560	Firefighting System
T-2.983.561	Open Drains, Closed Drains and Sanitary Waste Systems
T-2.983.564	Waste Heat Recovery Unit (WHRU)
T-2.983.589	Main Electrical Single Line Diagram
T-2.983.991	Control System Overview Diagram
T-2.983.992	Telecommunications Diagram

Note: Drawings provided in Attachment E *{confidential}*.

2.12.5
148.105(l)(5)
Onshore Storage Areas, Pipelines, and Refineries

No onshore facilities are proposed for construction or operation as part of this application. The Gulf Landing terminal will provide on-site storage for unloaded LNG. As LNG is vaporized, it will be delivered, via interconnected laterals, to existing offshore pipeline systems. These pipelines will commingle the vaporized LNG with other flowing supply within their respective systems and will, in turn, deliver their gas streams into the onshore national pipeline grid for transportation to the market areas of ultimate consumption[5]. Information regarding the construction of the offshore pipeline laterals, that are an integrated and integral part of this terminal, is contained in Section 2.18.

Natural gas, in its liquid or gaseous state, is not "refined;" however, natural gas may be "processed" to remove impurities that could harm pipeline infrastructure and/or to remove heavier hydrocarbons in the gas stream in order to prevent operational issues due to condensation within the pipe or to market the extracted "liquids" as a commodity. Applicant will not be privy to these types of processing considerations as those decisions are between the respective pipelines, processors, and the shippers or owners of the gas stream.

2.13
148.105(m)
Site Plan for Marine Components

The terminal will be located offshore Louisiana in WC 213. This location is approximately 38 miles (61 km) south of the Louisiana coast, in approximately 55 ft (16.8 m) water depth. Details of the site plan are described in the following sections.

2.13.1
148.105(m)(1)
Overall Site Plan

The terminal location is shown on Figures 2-1 and 2-2. Additional information on the terminal location, proposed anchorage areas, proposed ship routes, fairway proximity, and pipelines are shown on Drawing Number 03-003-1033 in the General Arrangement Drawing Series provided in Attachment D {*confidential*}.

2.13.2
148.105(m)(2)
Charted Water Depth

Drawing Number 03-003-1200 in Attachment F {*confidential*} shows the site water depth at specific locations within WC 213. This data was obtained from the National Oceanic and Atmospheric Administration Geophysical Data System (NOAA GEODAS) gridded bathymetric data.

2.13.3
148.105(m)(3)
Hydrographic Survey

A reconnaissance hydrographic survey of the terminal area in WC 213 using digital and analog echo sounder equipment was conducted and water depth accuracy within plus or minus (±) 1.4 ft (0.4 m) was obtained. Details of the hydrographic survey are contained in Attachment F {*confidential*}.

[5] Gulf Landing is in discussion with several offshore pipeline companies for potential interconnections. If negotiations culminate in interconnect agreements with these companies, Gulf Landing will supplement the license application with this information, including route surveys for the environmental review.

Water depths across the survey area range from 61 ft (18.6 m) in the southeastern corner of WC 213 to 48 ft (14.6 m) atop a local bathymetric high in the northwestern corner of the block. The bathymetry map of WC 213 delineates several highs in the western half of the block. These features appear to be remnant shoal features ranging from 6 to 9 ft (1.8 to 2.7 m) in height. No significant slopes were found and the survey indicated that there are no outcrops, major faults, or other potential hazards evident on the high-resolution geophysical data. Drawing Number 03-003-1034 in Attachment F *{confidential}* shows the location water depth contours from the hydrographic survey.

2.14
148.105(n)
Soil Data

Two surveys of the marine site, WC 213, and one survey of the proposed pipeline routes have been performed. A bathymetric and geophysical survey of WC 213 was completed in March 2003. The report summary is included as Attachment G *{confidential}*. The first phase of a geotechnical site investigation was completed in June 2003. The report summary is included as Attachment H {*confidential*}. A bathymetric and geophysical survey of the five proposed pipeline routes from the Gulf Landing terminal to their respective tie-in locations with existing pipelines was completed in September 2003 (see Attachment I {*confidential*}). These surveys were supplemented by a study of public and proprietary information on the local and regional geology of the site (*see* Attachment J {*confidential*}).

The seafloor within WC 213 is featureless with no outcrops or major surface faults. Three local highs, interpreted to be sand shoals, with 6 to 9 ft (1.8 to 3.0 m) of relief are situated in the western half of the block. The average seafloor gradient in the eastern half of the block is 0.01°. Steeper slopes of approximately 0.6° are found in the western half of the block on the northern flanks of the local highs. The Gulf Landing terminal will be situated on one of the local highs in a water depth of 55 ft (16.8 m) mean lower low water (MLLW). The seafloor along the pipeline routes generally slopes towards the south, with the average seafloor gradient ranging from flat to 0.6 degrees. Water depths along the surveyed routes range from 35 ft (10.7 m) MLLW in WC 171 to 62 ft (18.9 m) in WC 224.

Potential surface and sub-bottom hazards were mapped from the acquired geophysical data and include several acoustic void zones, two generations of buried channels, several buried faults, several zones of elevated seismic amplitude, numerous unidentified magnetic anomalies, and numerous sonar contacts.

Existing infrastructure at the marine site was confirmed by the geophysical survey and includes two pipelines and two abandoned wells. The locations of existing pipelines and wells were confirmed by the survey of the pipeline routes.

Geophysical data were analyzed for evidence of historic or prehistoric cultural resources. First and second generation buried channels were mapped at the terminal site, but no intact landforms were identified that could have indicated the potential for prehistoric sites. Avoidance criteria of 200 ft (61.0 m) were established for three magnetic anomalies, which may have potential archaeological significance due to their size. The pipeline route survey identified some relatively intact first generation buried channels, where archeological deposits may be present. Trenching of the proposed pipelines, to provide 3-ft of cover, is not expected to adversely affect these features, which downcut from 5 to 15 ft (1.5 to 4.6 m) below the seafloor. Avoidance criteria of 100 ft (30 m) were established for one sonar contact and two associated magnetic anomalies identified in WC 203.

Regional geologic studies indicate that the soils at the marine site comprise approximately 6 to 8 m of Holocene sediments overlying Pleistocene sediments. The near-surface geology has been largely influenced by fluctuating sea levels associated with climatic variations. Sea level stands in the late and early Wisconsin glacial periods have exposed the shelf area and subjected the soils to subaerial weathering and erosion processes. These geologic processes were confirmed by the identification of buried channels and unconformities in the high-resolution seismic profiles collected at the terminal site

Geotechnical data acquired at the marine site comprises a single soil boring to 97 ft (29.6 m) below the seafloor, 14 *in situ* piezocone penetration tests (PCPTs) to approximately 59 ft (18 m) below the seafloor and 16 piston cores with recoveries of 3 to 9 ft (0.9 to 2.7 m). The soil boring and one PCPT were performed within 50 ft (15.2 m) of the proposed Gulf Landing terminal center. Ten (10) PCPTs and four piston cores were performed within 200 ft (61 m) of the GBS footprint. The remaining PCPT and piston cores were performed in the general vicinity of the terminal. A program of laboratory testing was performed on the piston core and soil boring samples. The laboratory and *in situ* PCPT data were integrated to determine the shallow soil stratigraphy within the Gulf Landing footprint. The stratigraphy was found to be reasonably uniform at the terminal site and comprises a medium dense sand layer, 3 to 5 ft (1.0 to 1.5 m) thick, at the seafloor, which is underlain by a sequence of stiff overconsolidated clays to a depth of 97 ft (29.6 m) below the seafloor.

Seafloor soils along the pipeline routes are reported to consist of clayey sand across the majority of the surveyed area. Areas of sand are also reported and are supported by interpretation of the side scan sonar records, which revealed areas of high reflectivity and sand waves.

2.14.1
148.105(n)(1)
Soil Suitability

The major marine components associated with the terminal are the two concrete GBSs. Once installed, each GBS will be subject to dead, live and environmental loads . In-place design loads have been established in accordance with appropriate design codes for preliminary design of the GBS foundations (refer to “Basis of Design Part A,” Attachment K {*confidential*}). The relatively strong, overconsolidated, near-seafloor soils have lead to the selection of shallow skirt foundations as a base case for the GBS. Foundation design analyses have been performed to size the skirts for the anticipated design loads. The analyses allow for the cyclic degradation of the foundation zone soils under storm loads. The results of the analyses indicate that the foundations of the marine components achieve an appropriate level of safety against failure of the soil under the design loads.

The export pipelines associated with the terminal will be trenched to provide 10 ft (3.0 m) of cover at navigation fairway crossings and 3 ft (0.9 m) of cover elsewhere. The soil conditions revealed by the pipeline route survey indicate that the soils at the depth of pipeline burial will provide adequate support to the proposed pipelines. The existence of other trenched pipelines in the vicinity of the terminal site provides further evidence of the suitability of the soils to accommodate the proposed pipelines.

2.14.2
148.105(n)(2)
Seabed Stability

The terminal will be situated on a sand shoal that crosses the western boundary of WC 213. The stability of this bathymetric feature has been investigated by dating of selected specimens from piston core samples. The results of carbon 14 and radionuclide dating indicate that the 3- to 5-ft (1.0- to 1.5-m) thick sand layer at the seafloor is reworked during severe storms. Reworking of the upper 3 ft (1 m) is interpreted to occur approximately every 40 years. Reworking of the entire sand layer is estimated to have occurred within the past 2,000 years. The proposed skirt foundations of the GBS structures will confine the sand layer within the GBS footprints and erosion of the sand adjacent to the structures will be mitigated by placement of suitable scour protection as described in Drawing Number T-2.984.008 in Attachment D *{confidential}*.

Operation of the terminal is expected to have a negligible impact on the accretion or erosion of the coastline closest to the marine site, as the terminal site is approximately 38 miles (61 km) from the Louisiana coast.

2.15
148.105(o)
Operational Information

2.15.1
148.105(o)(1)
Carrier Specifications

The terminal is designed to accommodate LNG carriers in the 786,000 bbl (125,000 m^3) to 1,006,000 bbl (160,000 m^3) size range. Outline specifications for LNG carriers of these sizes are contained in Table 2-6.

Table 2-6
Outline Specifications of LNG Carriers

Specification	Minimum	Maximum
Capacity (m^3)	125,000	160,000
Displacement (tonnes)	81,000	124,000
Length Overall (m)	269	297.5
Length between perpendiculars (m)	257	283
Depth (m)	24.6	27.6
Beam (m)	41	48.7
Maximum draft (m)	10.7	12.0
Minimum draft (m)	8.9	11.1

Key: m^3 = Cubic meters.
tonnes = Metric tons.
m = Meters.

2.15.2
148.105(o)(2)
Charted Water Depth

The following calculation indicates that the minimum under-keel clearance meets the requirements of at least 1.5 m.

LNG carrier capacity (cubic meters)	125,000	160,000
Maximum Draft (meters [m])	10.7	12.0
Dynamic Vessel Response	2.0	1.7
Scour Protection	1.2	1.2
Water Depth (m)	16.46	16.46
Under-Keel Clearance (m)	2.56	1.56

2.15.3
148.105(o)(3)
Forecasting Conditions for Carrier Departures and Operational Interruptions

Forecasting of conditions for carrier departures and operational interruptions is a key element of the terminal operational procedures. The forecasting of wind, wave, and current conditions at the terminal will be by the local marine weather center. Communications systems maintained at the terminal ensure timely and reliable access to forecasting. Communications systems include satellite, telephone, radio, fax, and Internet access. Local measurement at the terminal will be by means of meteorological instruments installed on the terminal and on each LNG carrier, and by direct observation. Mooring line and fender loads will be monitored while the LNG carrier is on the berth, as well. The limits included below have been used for downtime analysis studies. The anticipated operational boundaries are included in Attachment O, “Marine Operations Manual” {*confidential*}.

Shutdown of LNG Transfer Operations

LNG transfer operations will be suspended if wind speeds exceed 29 knots (15 meters per second [m/s]). The unloading arms will be disconnected and returned to the stowed position during this period.

Departure of Carrier from the Mooring

The limiting conditions for safe de-berthing are wave heights of H_s = 1.75 m and mean hourly wind speeds of 34 knots (17.5 m/s) regardless of wind and wave directions and current speeds. For wave heights in the 1.75 to 2.25 m range, the limiting wind speed decreases linearly from 17.5 m/s to 0 m/s. However, if the weather forecast is for the wind to increase to greater than 50 knots (25.7 m/s), the berth may be cleared following consultation with the Mooring Master.

Vessels departures will not be authorized unless visibility is at least 0.5 nautical miles at the terminal.

Prohibition on Mooring

In general, the maximum limiting wind speed is 24.3 knots (12.5 m/s) and the maximum limiting significant wave height is 1.75 m for moving onto the berth. Limiting environmental conditions can be defined for all possible combinations of wind, wave, and current. Refer to the Marine Operations Manual (Attachment O {*confidential*}) for a comprehensive set of limiting conditions.

Vessels will not be berthed if the weather as forecast by the weather center over the planned time alongside indicates sustained wind speeds of 45 knots (23.1 m/s) or more. Vessels will not be accepted for berthing at the terminal unless visibility is at least 0.5 nautical miles at the terminal.

Shutdown of all Operations and Evacuation of the Port

All operations will be suspended, berthed vessels will be released, and all personnel will be evacuated in the event of a hurricane. This hurricane procedure will be initiated and executed, depending on the location, direction, and speed of the approaching storm.

2.15.4
148.105(o)(4)
Carrier Speed Limits in the Safety Zone

The safety zone for the terminal will extend for 0.31 mile (500 m). The LNG carrier speed limit within this radius will be 3 knots (1.54 m/s). Within the 2-mile (3.22-km) precautionary area, the carrier speed limit will be 5 knots (2.57 m/s).

2.16
148.105(p)
Data on Floating Components

No permanent floating structures will be associated with the terminal.

2.17
148.105(q)
Data on Fixed Offshore Components

This section describes the fixed offshore components of the terminal and the equipment and systems they support. Drawings of the fixed offshore components are contained in the General Arrangement Drawing Series listed in Table 2-4 and provided in Attachment D {*confidential*}. Additional information is provided in the documents "Basis of Design - Part A" (*see* Attachment K {*confidential*}) and "Basic Design Package - Part A" (*see* Attachment L {*confidential*}). Several of the drawings referenced in Attachment L (those listed in Tables 2-4 and 2-5) are contained in Attachments D and E {both *confidential*}, respectively.

2.17.1
148.105(q)(1)
Fixed Offshore Component Descriptions and Design Drawings

The terminal will consist of two concrete caissons, each with an integral LNG storage tank. The caissons will support facilities for LNG unloading, LNG vaporization, and natural gas send-out on deck. The terminal is designed to handle a nominal capacity of 7.7 million tonnes per year of LNG, equivalent to a nominal vaporization capacity of 1 Bcfd. The vaporization facilities will be designed for a peak capacity of 1.2 Bcfd. The terminal will be able to store 566,000 bbl (90,000 m^3) net in each tank providing a total net storage capacity of 1,132,000 bbl (180,000 m^3). Overall, the terminal will be 1,110 ft (338 m) long by 248 ft (75.6 m) wide and 114 ft (34.6 m) high.

The terminal is designed to berth LNG carriers having a liquid capacity in the range of 786,000 to 1,006,000 bbl (125,000 to 160,000 m^3). The berth will be located on the GBS with the LNG carrier mooring parallel to the GBS and the GBS acting as a breakwater.

Facility Layout

The layout of the facility was driven by safety and operability. The separation distance between the hydrocarbon process systems and the accommodation module has been maximized by placing the accommodation on the west end of the GBS and the processing equipment on the east end of the structure. This results in a separation distance between the accommodation and the pressurized hydrocarbon systems of approximately 150 m. The accommodation module will be located above ballast areas of the GBS and not above the atmospheric pressure LNG containment system. The accommodation module will also be separated from LNG storage within the GBS by the containment system and the concrete deck.

Further, the living quarters will be aligned with the LNG carrier accommodations, as the LNG carrier will berth on the north side of the terminal with its bow typically heading east. The helicopter deck will be located on top of the living quarters and the westerly location of the living quarters will enable an upwind helicopter approach during the governing wind direction.

Three escape capsules will be provided on the terminal. All three lifeboats will be 100% capacity. To improve the reliability and availability of the lifeboats in an emergency, two of the lifeboats will be placed near the living quarters and the third will be located at the other end of the facility.

An alternative refuge will be provided at the east end of the installation to act as a muster and evacuation point for major accident scenarios that prevent all personnel from reaching the accommodation and primary muster areas. This alternative refuge will be equipped with communication equipment and an additional escape capsule.

To minimize the liquid inventory for safety reasons, the main hydrocarbon equipment will be clustered on the eastern GBS, enabling short process lines. All process equipment including the re-condenser vessel can drain directly into the LNG storage tanks.

The low-pressure liquid header will be located on the south side of the process equipment; the high-pressure gas header will be located on the north side of the process equipment. The vent/flare will be located on the southeast corner of the eastern GBS.

The risers and metering plot will be located at the eastern end of the terminal because of the direction of the send-out lines. The water intake system will be located off the terminal structure and connected to the GBS by means of two pipelines. The outfall system will also be off the terminal structure and located south of the GBS.

Safe utilities will be placed between the accommodation module and hydrocarbon processing facilities to further act as a barrier between the accommodations and processing ends of the installation.

One mooring dolphin will be located approximately 65 ft (20 m) from the GBS eastern end to facilitate bi-directional mooring. Freestanding flexible steel piles will be located at the northeast and northwest corners of the GBS providing corner protection.

Consideration was given to locating the accommodation, flare tower, and LNG carrier berth on steel jacket structures external to the GBS. The technical, economic and safety assessments of these alternatives identified that although each of these options was technically feasible, the selected configuration met the safety objectives of the facility.

GBS

The main functions of the GBSs are to accommodate the LNG storage tanks, to safely support the LNG vaporization plant and other process equipment and utilities on the roof of the GBSs, and to safely enable LNG carriers to berth directly alongside the GBS.

The terminal will be composed of two steel-reinforced concrete structures, which will be built onshore, towed to the site, and set down on the seabed using well-proven construction methods and technology that has been commonly and successfully used in the offshore oil and gas industry for decades.

Each GBS will measure approximately 550 ft (167.5 m) long and 248 ft (75.6 m) wide. The top of the concrete structure will be approximately 110 ft (34.6 m) above the sea floor. The concrete deck level will be about 60 ft (18 m) above Chart Datum, which ensures that no wave overtopping or green water will occur in most environmental conditions.

The two GBSs will be placed end to end and will be connected to each other by a bridge structure. The gap of approximately 10 ft (3 m) will be closed off to prevent erosion of the seabed between the GBSs.

The width of the caissons excludes scour protection, which will extend up to 69 ft (21 m) around the GBS.

Each GBS will house a LNG storage tank of 566,000 bbl (90,000 m^3) net storage capacity. Between the storage tanks and the outer wall and bottom of the GBS, a grid of cells will be used for ballasting the GBS during transportation to the site, and to ground and to secure the GBS to the seafloor. In addition, the peripheral so-called “buffer belt” around the LNG tank will provide protection for the tanks against boat impact.

The structural layout will consist of a repetitive grid of plane walls and slabs. Longitudinal and transverse skirts located underneath the base slab will extend below the sea floor in order to achieve adequate bottom stability and prevent the GBS from sliding and overturning.

LNG Storage

The terminal will contain two integral LNG storage tanks, one in each GBS and each with net storage capacity of 566,000 bbl (90,000 m^3). The tanks are designed to limit LNG boil-off to approximately 0.1% of the contained LNG volume per day by means of insulation.

Each LNG storage tank will consist of a liquid and gas tight primary tank constructed within the concrete interior of the GBS. The LNG containment system may be the SPB rectangular tank system, the 9% nickel-steel cylindrical tank system, or the membrane tank system; either cylindrical or rectangular or any other acceptable containment system. Depending on the tank type, the primary tank will consist of stainless steel, aluminum, or 9% nickel-steel.

Cryogenic submerged pumps inside the tanks will transfer LNG from the storage tanks, via the re-condenser, to the suction of the LNG high-pressure send-out pumps. These LNG in-tank pumps will be high-volume, low-pressure pumps, and will provide sufficient net positive suction head (NPSH) for the deck mounted, high-pressure LNG pumps.

LNG Carrier Berthing

The terminal will be designed to berth carriers having a net LNG storage capacity in the range of 786,000 to 1,006,000 bbl (125,000 to 160,000 m^3]). The LNG carrier will berth directly alongside the north side of the GBS.

Six fenders will be required for the moored position. The LNG carriers' mooring lines run directly from the vessel based fairleads to the quick release mooring hooks on the GBS. To accommodate bi-directional mooring, one mooring dolphin will be located approximately 65 ft (20 m) from the GBS eastern end.

2.17.2
148.105(q)(2)
Design Criteria of Fixed Offshore Components

The design criteria for the Gulf Landing terminal facilities are defined in the document titled "Basis of Design - Part A" provided as Attachment K {*confidential*}.

2.17.3
148.105(q)(3)
Design Standards and Codes for Fixed Offshore Components

This section comprises a draft of the codes and standards philosophy to be used for the Gulf Landing terminal. It should be seen as preliminary and will be further refined during the project detailed design phase. The list of preliminary design codes and standards to be used for the GBS and the topsides are divided into the following groups:

- Structural;
- Foundation;
- Ship-Shore Interface;
- Offshore Transportation;
- LNG Storage;

- Process and Utilities;
- Piping and Mechanical;
- Electrical and Instrumentation;
- Health, Safety and Environment (HSE); and
- Miscellaneous.

The standards and codes for pipelines are contained in Section 2.18.3 (148.105 (r)(3)) and Section 2.18.4 (148.105 (r)(4)). Further assessment of applicable codes will be performed during the detailed design phase of the project.

Structural

The design of the GBS will generally follow the approach of the Det norske Veritas (DnV) Rules for Classification of Fixed Offshore Installations, 1999. Design and detailing of the concrete structure will generally be in accordance with British Standard (BS) 8110, 1997. Alternatively, consideration can be given to using the DnV Rules with concrete design code Norwegian Standard (NS) 3473, instead of the concrete design code BS8110.

General

- 30 CFR Chapter II, Part 250.900, Offshore Platforms.

American Petroleum Institute (API)

- API Recommended Practice (RP) 2A – WDS, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – Working Stress Design

American Welding Society (AWS)

- AWS D1.1-2000, Structural Welding Code: Steel

American Concrete Institute (ACI)

- ACI 357R-84 (97), Guide for the Design and Construction of Fixed Offshore Concrete Structures.
- ACI 357.2R-88 (97), State-of-the-Art Report on Barge-Like Concrete Structures.
- ACI 318, Design of Concrete Structures.

American Institute of Steel Construction (AISC)

- Manual of Steel Construction, Allowable Stress Design, Ninth Edition, 1989.

Det Norske Veritas (DnV)

- Rules for the Design and Construction of Offshore Structures.

- Rules for the Classification of Fixed Offshore Installations.
- DNV RP 205, Impact Loads from Boats, technical notes DNV TNA 202.
- DNV TNA 101, Design Against Accidental Loads.
- Norwegian Standard (NS) 3473: Concrete Structures, Design Rules”, 4th Edition (1992).

British Standards (BS)

- BS 8110 (97), Structural Use of Concrete.

Foundation

All recent major GBS projects have adopted the DnV Classification Notes 30.4 method for foundation design. This has been generally accepted as the most appropriate standard. Hence, it is proposed that the foundation design be carried out in accordance with the following guidelines:

Det Norske Veritas (DnV)

- DnV, 1995. Rules for Classification of Fixed Offshore Installations – Part 3 Chapter 1 Structural Design, General.
- DnV, 1992. Classification Notes: No. 30.4 – Foundations.

International Standards Organization (ISO)

- ISO 19901-2 - Seismic design procedures and criteria (if relevant).
- ISO 19901-4 - Geotechnical and foundations design considerations.
- ISO 19903 - Fixed concrete structures.

When the ISO and DnV guidelines conflict, the DnV guidelines will take precedence.

Ship-Shore Interface

General

- DNV “Rules for Classification of Fixed Offshore Installations,” January 1998.
- BS 6349, Part 4, “Design of Fendering and Mooring Systems,” 1985.
- 33 CFR Part 127, Liquefied Natural Gas Waterfront Facilities.

Oil Companies International Marine Forum (OCIMF)

- OCIMF 4, Design and Construction Specifications for Marine Loading Arms.
- OCIMF 20, Mooring Equipment Guidelines.
- OCIMF, Guidelines and Recommendations for the Safe Mooring of Large Ships at Piers and Sea Islands.

Society of International Gas Tanker and Terminal Operators (SIGTTO)

- Implementation Procedure (IP) No. 14, Site Selection and Design for LNG Ports and Jetties.
- IP No. 15, A Listing of Design Guidelines of Liquefied Gas Terminals.
- SIGTTO, Prediction of Wind Loads on Large Liquefied Gas Carriers.
- SIGTTO, Liquefied Gas Handling Principles on Ships and in Terminals.
- SIGTTO, Recommendations and Guidelines for Linked Ship/Shore Emergency Shut-Down of Liquefied Gas Cargo Transfer.

Offshore Transportation

General

- DNV "Rules for Classification of Mobile Offshore Units," July 1995.
- DNV "Mooring and Towage of Gravity Base Structures," November 1989.
- DNV "Environmental Conditions and Environmental Loads," March 1991.
- VMO Standard for Insurance Warrantee Surveys in Marine Operations, edition 1985.

LNG Storage

The storage concept is based on the EN 1473 standard "Installation and Equipment for Liquefied Natural Gas-Design of Onshore Structures"(replacing the former Group standard BS 7777) complemented by BS 8110, "Structural Use of Concrete" for the pre-stressed concrete outer tank.

General

- API 2000 - Venting Atmospheric and Low-Pressure Storage Tanks (1992).
- API Standard 620 - Design and construction of large, welded, low pressure storage tanks (1996).
- API MPM Manual of Petroleum Standard Chapter 2 "Tank Calibration" (1995).
- American National Standards Institute (ANSI)/API RP 520 - Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries, Part 1-1990, Part 2-1994.
- American Society of Mechanical Engineers (ASME)-ANSI Boiler and Pressure Vessel Code, Section II (material specification).
- ASME-ANSI Boiler and Pressure Vessel Code, Section V (Non destructive Examination).
- ASME-ANSI Boiler and Pressure Vessel Code, Section VIII (Rules for Construction of Pressure Vessels).
- BS 4447 - Specification for the Performance of Pre-stressing Anchorage for Post-Tensioned Construction.
- BS 4449 - Specification for Carbon Steel Bars for the Reinforcement of Concrete.
- BS 5328 Parts 1, 3, 4 - Methods for Specifying Concrete Including Ready Mixed Concrete.

- BS 5896 - Specification for High-Tensile Steel Wire and Strand for the Prestressing of Concrete.
- Rules for Building and Classing Steel Vessels (used for SPB LNG Tanks).
- Japan Gas Association - Recommended Practice for LNG Inground Storage LNG Containment.

Process and Utilities

American Petroleum Institute (API)

- API 607 - Fire Test for Soft Seated Quarter Turn Valves.
- API 670 - Vibration, Axial-Position and Bearing-Temperature Monitoring Systems.
- API RP 520 - Sizing, Selection, and Installation of Pressure Relieving Devices in Refineries, Installation.
- API RP 521 - Guide to Pressure Relieving and Depressuring System Design.
- API RP 526 - Flanged Safety Relief Valves.
- API RP 527 - Commercial Seat Tightness of Safety Relief Valves with Metal-to-Metal Seats.
- API RP 552 - Transmission Systems.
- API RP 6D, Specifications for Pipeline Valves.
- API RP 14C, Recommended Practice for Analysis, Design, Installation and Testing of Basic Surface Safety Systems for Offshore Petroleum Platforms (Adherence to this code is mandatory in GoM and regarded as a minimum standard.).
- API RP 1111, Design, Construction, Operation, and Maintenance of Offshore Hydrocarbon Pipelines.
- API RP2G, Recommended Practices for Production Facilities on Offshore Structures.
- API Std. 613, High-Speed, Special-Purpose Gear Units for Refinery Service, Latest Edition.
- API Std. 614, Lubrication, Shaft-Sealing, and Control Oil Systems for Special-Purpose Applications.
- API RP 2003, Protection Against Ignitions Arising Out of Static, Lightning and Stray Current, 1974.
- API 673, Special Purpose Centrifugal Fans, Latest Edition.
- API RP Std. 618, Reciprocating Compressors for General Refinery Services, Latest Edition.
- API Std. 672, Packaged Integrally Geared Centrifugal Plant and Instrument Air Compressors, Latest Edition.
- API RP 617, Centrifugal Compressors for General Refinery Services, Latest Edition.
- API 671, Special Purpose Couplings.
- API Std. 601, Metallic Gaskets for Refinery Piping (Double-Jacketed Corrugated and Spiral Wound) Latest Edition.

- API 678, Accelerometer Base Vibration Monitor Systems.
- API Std. 610, Centrifugal Pumps for General Refinery Services, Latest Edition.
- API 616, Type H Combustion Gas Turbines, Latest Edition.

Piping and Mechanical

General

- API RP 14E, Recommended Practice for Design and Installation of Offshore Production Platform Piping Systems.

American Society of Mechanical Engineers (ASME)

- ASME/ANSI B31.3, Process Piping.
- ASME/ANSI B31.4, Pipeline Transmission Systems for Liquid Hydrocarbons and Other Liquids.
- ASME/ANSI B31.5, Standards for Refrigeration Piping.
- ASME/ANSI B31.8, Gas Transmission and Distribution Systems.
- ANSI/Flow Control Industries (FCI) 70-2 - Control Valve Seat Leakage.
- Anti-Friction Bearing Manufacturers Association (AFBMA) Sect. 4, Standard for Gauging Practices.
- ANSI B.21, Pipe Threads.
- ANSI B16.5, Steel Pipe Flange Fittings.
- ANSI B1.1, Unified Inch Screw Threads.
- ANSI C96.1, Temperature Measurement Thermocouples, Latest Edition.
- American Society for Testing and Materials (ASTM) A 370, Mechanical Testing of Steel Products, Latest Edition.
- ASTM F104, Standard Classification Systems for Nonmetallic Gasket Material, Latest Edition.
- ASTM B-286, Specification for Copper Conductors for Use in Hookup Wire for Electronic Equipment.
- Test and Evaluation Management Agency (TEMA), Standard of Tubular Exchangers Manufacturers Association, Latest Edition.

Electrical and Instrumentation

General

- 46 CFR Chapter I Subchapter J, Electrical Engineering.

American Petroleum Institute

- API RP 500, Recommended Practice for Classification of Areas for Electrical Locations at Petroleum Facilities.
- API RP 14F, Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities.

- API RP 554 - Process Instrumentation and Control.
- API MPMS - Manual of Petroleum Measurement Standards.
- API RP 550 - Manual on Installation of Refinery Instruments and Process Control Systems.
- API Std. 2534, “Measurement of Liquid Hydrocarbons by Turbine Meter Systems.”
- API RP 551 - Process Measurement Instrumentation.

National Electrical Manufacturers Association (NEMA)

- NEMA Marine Geological Institute (MGI) Std., Motors and Generators.
- NEMA ICSI-110, Enclosures.
- NEMA C52.1, 1973 Motors and Generators (NEMA MG-1).
- NEMA IS 1.1, Enclosure for Industrial Controls and Systems, Latest Edition.

International Electrotechnical Commission (IEC)

- IEC 61508, Parts 1-7, “Functional Safety: Safety Related Systems.”
- IEC-61131-1 - Programmable Controllers – Part 3: Programming Languages.

Instrument Society of America (ISA)

- ISA RP7.1 - Pneumatic Control Circuit Pressure Test.
- ISA RP7.4 - Air Pressures for Pneumatic Controllers, Transmitters and Transmission Systems.
- ISA S 20 - Specification Forms for Process Measurement and Control Instruments, Primary Element and Control Valves.
- ISA S 5.1 - Binary Logic Diagrams for Process Operations.
- ISA S 5.3 - Graphic Symbols for Distributed Control/Shared Display Instrumentation, Computer Systems.
- ISA S 5.4 - Instrument Loop Diagram.
- ISA S 5.5 - Graphic Symbols for Process Display.
- ISA S 75.01 - Control Valve Sizing Equations.
- ISA S 75.19 - Hydrostatic Testing of Control Valves.
- ISA S12.13 (Part II) - Performance Requirements, Combustible Gas Detectors.
- ISA RP 123 Part II - Installation, Operation and Maintenance of Combustible Gas Detection Instruments.
- ISA S7.0.01 - Quality Standard for Instrument Air.
- ANSI/ISA 584-01 - Application of Safety Instrumented Systems for the Process Industry.
- ISA 5 5 .1 – Instrumentation Symbols and Identification, Latest Edition.
- ISA RP 20.1 – Specification Forms, Latest Form.

- ISA RP 20.2 – Specification Forms, Latest Form.
- ISA RP 3.2 – Flange Mounted Sharp Edged Orifice Plates for Flow Measurement, Latest Edition.

Health, Safety, and Environment (HSE)

General

- 33 CFR Subpart D, Part 149, Fire-Fighting and Fire-Protection Equipment.
- 33 CFR Subchapter O, Pollution.
- 33 CFR Subchapter P, Ports and Waterways Safety.
- 40 CFR, Protection of Environment.
- 46 CFR Part 154, Safety Standard for Vessel Carrying Bulk Liquefied Gases.
- 49 CFR Part 193, Liquefied Natural Gas Facilities: Federal Safety Standards.
- API RP 14G, Recommended Practice for Fire Prevention and Control on Open Type Offshore Production Platforms.
- API RP 14J, Recommended Practice for Design and Hazards Analysis for Offshore Production Facilities.
- API RP 75, Recommended Practice for Design and Operation of a Safety and Environmental Management Program for Outer Continental Shelf (OCS) Operations and Facilities.
- U.S. Food and Drug Administration (FDA) Requirements for Potable Water.
- API 14C.
- United States Environmental Protection Agency (USEPA) National Pollutant Discharge Elimination System (NPDES; water discharge).

National Fire Protection Association (NFPA)

- NFPA 11A: Foam Systems.
- NFPA 12: CO_2 Systems.
- NFPA 13: Water Sprinkler Systems.
- NFPA 70: National Electric Code (NEC).
- NFPA 72: National Fire Alarm Code.
- NFPA 72A: Local Protective Signalling Systems.
- NFPA 75: Electronic Computer/Data Processing Equipment.
- NFPA 80A: Protection of Buildings from Exterior Fire Exposures.
- NFPA 85B: Explosion Prevention Multiple Burner Boiler-Furnaces, Gas-fired.
- NFPA 87: Piers and Wharves.
- NFPA 96: Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.

- NFPA 231: Indoor General Storage.
- NFPA 493: Intrinsically Safe Process Equipment, Latest Edition.
- NFPA 497: Recommendation Practice for the Classification of Flammable Liquids, Gases or Vapors and Hazardous (Classified) Locations for Electrical Installations in Chemical process Areas.
- NFPA 1963: Fire Host Connections
- NFPA 59A: Standard for the Production, Storage and Handling of Liquefied Natural Gas (LNG).

International Standards Organization (ISO)

- ISO 13702, Control and Mitigation of Fires and Explosions on Offshore Production Facilities.
- ISO 17776, Guidelines on Tools and Techniques for Hazard Identification and Risk Assessment.

Miscellaneous

General

- Underwriters Laboratories (UL) Std. 299, Dry Chemical Fire Extinguishers
- Hydraulic Institute (HI) Standards.
- Insulated Power Cable Engineers Association (IPCEA) S-61-02, Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA Publication No. WC 5).
- 33 CFR Part 322, Permits for Structures in or Affecting Navigable Waters of the U.S.
- 33 CFR Subchapter C, Part 67, Aids to Navigation on Artificial Islands and Fixed Structures.
- 33 CFR Subpart E, Part 149, Aids to Navigation.
- 33 CFR Chapter I, Part 149, Design, Construction, and Equipment.
- 33 CFR Subpart H, Part 150, Aids to Navigation.
- 33 CFR Subchapter N, Outer Continental Shelf (OCS) Activities.
- 33 CFR Subchapter NN, Deepwater Ports.
- American Bureau of Shipping (ABS), Guidance Notes on Building and Classing Offshore LNG Terminals.
- API RP 2L, Recommended Practice for Planning, Designing & Constructing Heliports for Fixed Offshore Platforms.
- API RP 2C, API Specification for Offshore Cranes.

2.17.4
148.105(q)(4)
Engineering Practices for Fixed Offshore Components

The engineering design standards and codes to be used are included in Section 2.17.3 of this application. Shell has numerous process, system, material and/or equipment specific design specifications and practices, some of which cover areas not specifically addressed within the industry or government codes and standards listed. A summary of each Shell specification or practice to be used, including identification of the underlying international or U.S. standard(s) if applicable, will be provided during the detailed design phase of the project prior to the “Approved for Construction” drawing submittal. Copies of individual specifications or practices will be provided upon U.S. Coast Guard request.

2.17.5
148.105(q)(5)
Design and Evaluation Studies for Fixed Offshore Components

Several design and evaluation studies were performed and used in the development of this application. These studies are described below.

Vaporizer Comparison Study

The purpose of this study was to perform a comparative evaluation and recommend which type of LNG vaporizer is most suitable for the Gulf Landing terminal from the vaporization configurations available. Four main types of vaporizer exist: open rack, submerged combustion, intermediate fluid, and shell and tube.

Open-Rack Vaporizer (ORV)

ORVs have been used extensively within onshore plants. Their high reliability and low operating cost make them a particularly attractive choice for base-load vaporization plants. ORVs are particularly suited for use on GBSs because there is no pitching and rolling motion associated with floating structures since the GBSs are supported by the seabed.

Submerged Combustion Vaporizer (SCV)

SCVs also have a long history of operation within onshore plants, particularly where lower vaporization rates are required, or the ambient conditions prohibit the use of water as the heating medium. The SCV suffers from a higher operating cost (due to burning fuel gas) but can be an option for sparing of ORVs. The SCV gas-fired burners may impact the topside layout due to safety and area classification issues associated with fired equipment.

Intermediate Fluid Vaporizers (IFV)

Although the reference list for onshore applications of IFVs includes 17 installations, the list is not as lengthy as for the two vaporizers discussed above. The use of IFVs for onshore terminals is usually discounted due to their higher initial cost and the safety issues associated with the storage and possible release of the intermediate fluid (typically propane). Operating costs are similar in nature to the ORV, assuming a similar seawater temperature drop.

Shell and Tube Vaporizers

Although designs for shell and tube vaporizers using seawater as the heating medium exist, there is no base-load experience associated with this type of unit. Numerous reports have raised concerns of seawater freezing in the event of seawater supply failure. Although testing of such units is ongoing, concerns have not yet been addressed to a satisfactory level for this vaporizer type to be considered as a feasible alternative.

Shell and tube exchanger designs using steam or water glycol as the heating medium exist; however, they only become feasible alternatives when advantage can be taken of an existing heat source or steam system.

From the above considerations, ORVs and SCVs are considered as the two most feasible vaporization systems for the project. The vaporizer types were evaluated with respect to Shell's seven principles of sustainable development, which are as follows:

- Deliver value to customers;
- Protect the environment;
- Manage resources;
- Respect and safeguard people;
- Work with stakeholders;
- Generate robust profitability; and
- Benefit communities.

The use of ORVs for the Gulf Landing Project is recommended for the following reasons:

- Since ORVs utilize seawater as the heating medium, emissions to the atmosphere are significantly less. SCVs burn a considerable amount of fuel gas, releasing carbon dioxide and other combustion products (nitrogen oxides [NO_x], etc.) to the atmosphere.
- The operating cost for ORVs is significantly lower than that for SCVs due to the significant fuel gas consumption for SCVs. As a result, the lifecycle cost for the ORV option is the more economical of the two options.
- The use of SCV's results in the combustion of 1.5 to 2% of the LNG for vaporization. This significant increase in energy usage is not consistent with management of resources, as the alternative ORV technology is technically practical for this application.
- The overall availability of an ORV is expected to be higher than an SCV. Thus, downtime for repair and replacement is significantly less.
- ORVs have demonstrated an excellent safety record in facilities where they are installed.
- Safety risks are anticipated to be lower for the ORVs. As SCVs contain a burner, and therefore represent an ignition source, the safety and area classification implications are more onerous. However, both options are considered manageable from an HSE perspective.
- The year-round warm seawater temperature in the GoM enables ORVs to be used throughout the year. SCVs are typically used more often in colder climates where this is not possible.

- ORVs cannot be placed on moving structures such as floating storage and regasification units (FSRUs); however, the GBS concept is a stable, non-moving structure.

LNG Spill Containment Analysis

The purpose of the LNG spill containment analysis was to recommend a spill containment strategy for the project. The recommended strategy is to direct major LNG spills safely overboard into the sea where the majority of the LNG will vaporize on the sea surface, well away from the facility deck. Smaller spills will vaporize through aerosols formed by the mechanical and thermal break-up of jets. The recommended strategy is supported by the following measures:

- Leak prevention through material selection, minimization of leak paths, and integrity management.
- Automated emergency shutdown (ESD) system that includes detection, isolation, shutdown, and depressurization systems to minimize spill sizes.
- Deck curbing, stainless steel drip pans, and stainless steel drain systems to ensure spills are directed overboard to protect important process equipment and structures.
- Structural cold protection for important structures at likely contact areas.
- Appropriate emergency response procedures.

Each of the preventative and protective systems will be defined and designed during the detailed design phase of the project.

The above spill containment strategy was developed based on safety to personnel, the GBS, and the LNG carrier. The intent is to minimize the potential for a gas cloud accumulation, fires, and explosions by allowing the release to disperse safely away from the installation and people.

Course Hazard Identification

A course hazard identification (HAZID) study by a team of multi-discipline personnel was completed for the project. The purpose of the study was to identify HSE hazardous events, assess the risk associated with those events, record the HAZID process as the basis for a Hazard Register and recommend actions to be resolved to further understand or manage the identified hazardous events.

The study identified several areas for further engineering and development and made recommendations considered appropriate to further understand the risk exposure or to remediate the identified risks.

Facility Layout Study

The purpose of the facility layout study was to recommend a particular layout of major components relative to one another. Significant factors considered during the layout study included:

- Prevailing environmental conditions, including wind, wave, and current;
- Berth orientation with respect to environmental conditions;
- Location of the accommodation block;
- Location of the flare;

- Location of the hydrocarbon containing and high pressure equipment;
- Berthing and unloading of the LNG carrier;
- Routing of seawater intake and discharge pipelines; and
- Routing of the facility natural gas pipelines to the existing tie-in pipelines.

2.17.6 148.105(q)(6) Lighting, Safety, Lifesaving, Firefighting, Pollution Prevention/Removal, and Waste Treatment Equipment

The following sections describe the pertinent equipment associated with Section 148.105(q)(6).

Navigational Lighting

In addition to the installation of general deck lighting on the fixed structure, navigation warning lights and aviation warning lights will be installed. The navigation lights will be provided as required by 33 CFR Part 149 Subpart E, Aids to Navigation. Aviation warning lights will be installed on the terminal's vent tower and other tall structures (e.g., fixed cranes). These lights and their controller will meet all FAA and FCC requirements. Alternating blue and yellow omni-directional taxiway lights will be installed to outline the heliport landing area. The terminal will be fitted with twelve (12) obstruction lights arranged as shown on Drawing Number 03-003-7000 (*see* Attachment D {*confidential*}). Each of the terminal's obstruction lights will be an assembly consisting of one or more marine lanterns that will meet the intensity, flash interval, and vertical divergence requirements of 33 CFR § 149.521 through § 149.527, respectively. Each fixed structure obstruction light will be installed approximately 75 ft (23 m) above sea level.

Personnel Safety Equipment

The following safety equipment will be installed, and in use, on the terminal.

- Personnel protection equipment (PPE):
  - Approved hard hat (non-metallic);
  - Approved eye protection (with side shields);
  - Approved hearing protection (in designated areas);
  - Approved safety shoes; and
  - Fire retardant clothing (in designated areas).
- General alarm and public address (PA) system:
  - A combination PA/intercom/general alarm system will be provided for the facility. This system will be in accordance with the requirements of 33 CFR § 149.541 and §149.545. Page-party handset stations will be located throughout the terminal for local communications. The general alarm speaker system will be used by the page-party system for annunciation of voice messages.

- Eyewash equipment:
  - Portable or fixed eyewash equipment will be provided in chemical handling and storage areas.

Lifesaving Equipment

The primary means of egress from the facility will be by helicopter. The secondary means of evacuation will be by enclosed escape capsules. The preliminary safety reviews and layout of the facility have recommended two 60-man capacity lifeboats (escape capsules) located near the accommodation module on different sides of the installation. An additional 100% capacity lifeboat will be on the east end of the installation. Launching and retrieval of survival crafts are accomplished by means of davit and winch system.

Life rafts will be mounted on the four corners and at mid-length of the north and south faces of the facility in accessible locations. All lifeboats will be equipped with emergency very high frequency (VHF) marine radios, emergency position-indicating radio beacons (EPIRBs), and search-and-rescue radar transponders (SARTs). Rafts will be equipped with integral EPIRBs, (VHF) marine portable radios, and SARTs will be available nearby. Means to access the life rafts and to allow people to escape from the installation to the sea level will be provided, as necessary.

Type I (according to U.S. Department of Transportation requirements) personal flotation devices (PFDs) – one per person – will be located in the cabin areas of the quarters building. Additional Type I PFDs equal to the number of bunks in the quarters building will be stowed near the lifeboats in well ventilated and accessible lockers marked “life preservers.”

Life ring buoys, with an attached approved automatic electric water light, will be placed in accessible places around the outside of the facility.

Fire-Fighting Equipment

The fire protection system consists of the following components or systems:

- Two diesel-driven firewater pumps: Each pump will be capable of supplying 100% of the maximum firewater demand and will be mounted on its own skid with its auxiliary systems (lube oil, cooling water, and diesel fuel) on skid, as well. The pump will be controlled by its own local control system. This system is connected via hardwired signals to the emergency support system (ESS) controller and via ethernet to the platform control system for monitoring and alarming.
- A jockey pump to maintain the firewater header pressure with one installed spare.
- An automatic fire and gas detection and alarm system with read-out in the terminal’s main control room will be installed to meet the requirements of 33 CFR § 149.491. Audible alarms will be annunciated over the general alarm speaker system. In high noise areas, visual alarms will be installed in addition to audible alarms.
- Firewater deluge for equipment protection within the process areas as determined beneficial during the detailed design phase fire analysis.
- Low expansion foam (aqueous film-forming foam [AFFF]) deluge system in the:
  - diesel storage and transfer area; and
  - helideck.

- Sprinkler systems in the:
  - quarters building; and
  - storage building.
- Water mist systems in the:
  - turbine generator enclosures;
  - emergency generator enclosure;
  - essential generator enclosures; and
  - paint locker.
- AFFF foam hose reels for helideck and diesel storage area.
- Hose cabinets in the quarters building.
- Portable, chemical fire extinguishers throughout the facility in accordance with 33 CFR § 145.10, Table 145.10(a) – Portable and Semi-Portable Extinguishers. In accordance with Shell's Safe Practices, the maximum travel distance from any point on a platform deck having a potential for fire to an extinguisher should not exceed 50 ft.
- Nitrogen snuffing systems for atmospheric vent.
- Fire suppression system for galley vent hood.
- Firemen's outfits and equipment for fire teams.

Pollution Prevention and Removal Equipment

Pollution prevention and removal equipment will be maintained by Applicant in accordance with an Oil Spill Response Plan.

2.17.7
148.105(q)(7)
Descriptions and Design Drawings of Oil Pumping Equipment, Piping and Control/Instrumentation Systems, and Other Associated Equipment

This section provides a description of the LNG unloading, storage, pumping, vaporization, and handling facilities. The LNG process facilities provide for the delivery of LNG to the process area, vaporization of the liquid into natural gas, and heating and delivery of natural gas via a metering system to the takeaway gas pipelines. The terminal will be designed for a nominal average annual throughput of approximately 7.7 million tonnes per annum (mtpa) equivalent to 1 Bcfd.

A schematic diagram of the LNG storage and process system is shown on Figure 2-3. Additional drawings of the system are contained in the schematic diagram series (Table 2-5) provided in Attachment E {*confidential*}.

The LNG Handling Equipment

Unloading System

The terminal unloading facilities will be designed to safely accommodate LNG carriers from 786,000 to 1,006,000 bbl (125,000 to 160,000 m^3) in regular operation. LNG will be unloaded to the storage tanks at a maximum rate of 1.8 million barrels per day (Mmbpd; 12,000 m^3/hr) using the LNG carriers' cargo pumps. The LNG will be transferred by means of four unloading arms. Three unloading arms will be used for unloading the LNG; one unloading arm will be used for returning vapor displaced in the terminal storage tanks back to the LNG carrier. One of the three liquid arms may be used for either liquid or vapor service as required allowing maintenance of the vapor return arm. Between unloading operations, the unloading system will be kept cold by a small quantity of LNG re-circulation.

LNG Unloading Arms

The LNG unloading arms will consist of a fixed vertical riser and two mobile sections, the inboard arm and the outboard arm. At the end of the outboard arm will be a flange for connection to the carrier. Swivel joints will enable the arms and the connecting flange to move freely in all directions. The length of the unloading arm is designed to accommodate the difference in size of the range of carriers to be received, the elevation change between LNG carrier fully laden and empty condition, the movement of the ship due to tide and longitudinal and transfer drift, and the elevation of the GBS.

The liquid and vapor arms will be equipped with an emergency release system. When the connecting flange reaches the limit of its operating envelope, an alarm will sound, the cargo pumps will shut down, and the unloading arm valves will close. Automatic disconnection of the unloading arms from the ship manifold will then occur. The arms will normally be operated from a control panel in a cabinet located on the GBS close to the arms.

LNG Storage Tanks

The LNG will be stored in tanks located and supported inside the concrete GBS. The GBS will consist of two individual box (caisson) sections each containing one LNG storage tank. The net operating storage capacity of each tank will be 566,000 bbl (90,000 m^3) and the total net capacity will be 1,132,000 bbl (180,000 m^3). The containment system is designed to store the LNG at near atmospheric pressure and a temperature of –160ºC (-256ºF).

Each tank will be equipped with safety devices and monitoring will be available from the control room to ensure safe operations and protection against overfills, roll over, overpressure, or low pressures. An extensive temperature measurement system will be installed in the LNG tanks at various levels.

Automatic continuous tank level gauging, density monitoring, and density measuring will be provided. Each level indicator will have high and low alarms and will automatically stop in-tank pumps or unloading operations, as required.

Pressure transmitters will be provided in each tank to control the boil-off gas compressor, the vent system, alarms and to actuate the emergency shutdown system. Each tank will be protected against overpressure by safety valves. The tank pressure relief valves will release to atmosphere via the vent system.

Boil-Off Gas (BOG)

Vapor is formed due to heat ingress from the storage tank, heat introduced into the tank during ship unloading, heat ingress from the LNG recirculation lines and by changes in the fluid composition when LNG is unloaded into the storage tanks. This vapor is referred to as boil-off gas (BOG). The normal BOG rate is expected to be 0.1 % per day of the total storage volume. BOG is used to balance the pressure in the LNG carrier while unloading.

Boil-Off Gas Compressor

The BOG will be compressed by the BOG compressor and routed to the re-condenser. One spare BOG compressor will be installed.

During hurricanes, the terminal will be abandoned and gas send-out will cease. All non-critical operations will be shut down and, as a result, excess boil-off gas will be flared.

Re-Condenser

The re-condenser will re-condense all of the boil-off gas and provide sufficient pressure and surge volume at the suction of the high-pressure LNG send-out pumps. The main flow of the LNG from the in-tank pumps will be routed directly to the re-condenser vessel. The BOG will be re-condensed by mixing it with a portion of this cold LNG being pumped out of the LNG storage tanks.

The re-condensed BOG will mix with the LNG inside the re-condenser and then be routed to the gasification trains. The re-condenser is designed to process all of the boil-off generated in the GBS, including ship unloading vapors.

LNG In-Tank Pumps

The in-tank LNG pumps will transfer LNG from the LNG storage tanks to the process facilities. The low-pressure in-tank pumps will be centrifugal submerged motor pumps, installed in vertical pump wells inside the storage tank.

LNG High Pressure Pumps

High-pressure pumps will bring the required maximum flowrate of 362,000 bbl/day (2,400 m^3/hr]) of LNG to the pipeline send-out pressure. The pumps are designed for cryogenic service. One spare high-pressure pump will be installed.

Open-Rack Vaporizers

The LNG flow from each high-pressure pump will be passed to an ORV where the LNG is vaporized at high pressure. The LNG will be fed through aluminum tubes while seawater flows from the top of the vaporizers over the tubes whereby the vaporization will take place. The maximum seawater differential temperature (the difference between the seawater discharge and intake temperatures) will be 18ºF (10ºC). Six (6) ORVs will be in normal operation, with one additional ORV installed as a spare.

Seawater will be used, as the heating medium for the ORVs to vaporize the LNG in a once-through mode. Seawater lift pumps will deliver the seawater to the vaporizers from the seawater intake structure. The seawater intake structure will have suitably sized intake screens (0.25 inch), intake velocity (<0.5 ft/s), intake location and orientation to minimize the potential for marine life entrainment and impingement. The seawater will be treated to minimize marine growth within the system and discharged at the outfall structure located south west of the Terminal. Figure 2-5 shows the location of the intake and outfall structures relative to the GBS structure.

Sales Gas Heaters

The send-out gas will be heated in order to mitigate the possibility of hydrate formation in the takeaway pipelines. Two (2) sales gas heaters will be in normal operation, with one additional installed spare. The heating medium will be demineralized hot water, heated in the WHRU.

LNG and Gas Quality Measurement

Custody transfer for the LNG discharging from the LNG carrier will be based on ship level measurements to determine volume and online gas chromatography measurements to determine composition. The LNG chromatograph will be located downstream of the unloading arm prior to the tank inlet. A dome sampler, that collects a composite sample over the entire unloading period, will be used. Vaporized LNG will also be analyzed by gas chromatograph; the gas sampling point will be on the sales gas header.

Send-Out Gas Transportation and Metering

After heating, the gas stream will be divided between the takeaway pipelines. Each pipeline will have its own pressure reduction station and two or more 10-inch ultrasonic custody transfer meters to accommodate the export flow rate.

LNG Circulation System

All significant lengths of cryogenic piping and equipment will remain cold during normal operation by the presence of LNG. Lines where this is not possible (e.g., the vapor return line) will be designed for thermal cycling. Recirculation will be established from the low pressure LNG send-out header on the LNG storage tanks to the unloading manifold and directly back into the tanks. Compared to a conventional onshore LNG import terminal, the heat ingress (and hence the required rate of LNG circulation) will be somewhat limited due to the short distance between the LNG carrier and the storage tanks.

Relief System

The relief system will include three relief headers, one flare header, and two emergency vent headers (low pressure and high pressure vents). The flare header, that will connect to the tank vapor space, balance line, and depressuring lines will operate during tank cool down and overpressure scenarios and in hurricane situations where the GBS will be de-manned and the vaporization process stopped. A self-igniting flare will be provided to safely dispose of emergency process releases. The majority of the process relief valves will be routed via the flare. The flare system detects a release of emissions and self-ignites when required. The ignitable flare concept will minimize the overall greenhouse gas emissions to atmosphere of the facility. Under normal operating conditions, the facility will have zero flaring, any boil-off gases will be recondensed to LNG liquid and routed to the high pressure LNG pumps.

The emergency vent header will collect the tank pressure relief valves and will be connected to atmosphere. The vent stack is designed to accommodate all relief loads from the tank and can be used during flare maintenance. The vent stack will be located in the same structure as the flare.

All thermal relief valves will relieve back to the vapor balance line. All pressure safety valves will be connected to the flare relief header, except vaporizer pressure relief valves, which discharge directly to atmosphere via a single-service vent stack.

To protect the primary membrane, insulation spaces will be protected from over and under pressure by locally relieving pressure/vacuum valves.

The Piping System

All piping on the facility will be designed, constructed, and tested in accordance with ASME B31.3. Piping containing LNG will be constructed of ASTM A312, Grade TP316L stainless steel and will be insulated. The maximum allowable working pressures (MAWP) of various segments of the LNG piping will be:

- 8.5 bar gauge (barg)MAWP for the unloading arms to the suction of the LNG pumps;
- 100 barg MAWP for discharge of the LNG pumps to the vaporizers;
- Send-out gas piping will be constructed of ASTM A106, Grade B carbon steel. The MAWPs will be 100 barg;
- Seawater and drain piping will be constructed of fiberglass per ASTM D2996;
- Firewater piping will be constructed of fiber-reinforced plastic (FRP) or 09/10 copper/nickel (Cu-Ni) materials; and
- Graywater and blackwater piping will be constructed of polyvinyl chloride (PVC).

Control and Instrumentation Systems

The facilities on the terminal will be operated from a central control room (CCR) with provisions for limited onshore control during hurricanes. The terminal will be controlled by one plant-wide distributed control system (DCS) and safeguarded by one plant-wide instrumented protective system (IPS). Both systems will incorporate all plant control and safeguarding, including that of packaged units. Where necessary, due to the specialized nature of some packaged unit/subsystems, data from the unit/subsystem will be communicated with the DCS via redundant high-speed communication links. All local safety-related communication systems on the terminal will be hard wired.

Other Associated Equipment

Fire and Gas Detection and Alarm System

An automatic fire and gas detection and alarm system with read-out will be installed in the CCR to meet the requirements of 33 CFR § 149.491. Audible alarms will be annunciated over the general alarm speaker system. In high noise areas, visual alarms will be installed in addition to audible alarms.

Combination Public Address, Intercom, and General Alarm

A combination public address (PA)/intercom/general alarm system will be provided for the facility in accordance with the rules of 33 CFR § 149.665 through § 149.675. Page-party handset stations will be located throughout the terminal for local communications. The general alarm speaker system will be used by the page-party system for annunciation of voice messages.

Fire Suppression System

Water-mist fire-suppression systems will be installed to protect the generator driver enclosures.

LNG Send-Out Metering

The purpose of the natural gas metering units is to perform the measurement of the quantity and quality of natural gas delivered at the terminal outputs. The measurements will be a high accuracy of approximately ± 0.5 % for custody gas delivery operation. Ten-inch (250 millimeter [mm]) ultrasonic multi-path gas flow meters with a capacity of 255 million standard cubic feet per day (MMscfd; 7.2 million standard cubic meters per day [MMscmd]) will be used.

Tank Gauging and Over-Fill Prevention

Two independent working level gauges will be installed. In addition, a third, manual float type level gauge will be installed. High-level alarms will be independent of the primary gauging system.

Leak Detection

To continuously monitor for LNG leaks, the tank will be equipped with a leak detection system. The insulation space monitoring system will continuously scan to detect a potential methane gas concentration. The gas sampling system will consist of infrared type gas analyzers. The monitoring system will provide an alarm in the control room when LNG leakage is detected. The monitoring system also will provide a system alarm if it malfunctions.

Rollover Prevention

LNG tanks will be monitored for signs of stratification by means of at least one traversing density / temperature instrument. In addition, two filling connections will be provided, a bottom fill and a top fill connection. In the unlikely event of rollover, the tank relief valves are designed to accommodate the corresponding vapor flow rate.

Detection Systems

Flammable gas detectors will be installed on the GBS near the most probable leak sources and other locations. Heat detection will be installed on the GBS concrete deck where water-spray will be used for the protection of equipment. The tank shell and bottom will be continuously monitored at various locations to indicate the temperature profile.

A heating system will be installed in the concrete bottom slab to prevent frost heave of the subsoil. Electrical heating elements (tapes) will be placed in American Iron and Steel Institute (AISI) 316 stainless steel conduits.

A continuous temperature monitoring system for the bottom slab is required. The system will consist of heating controls/alarms. Temperature sensors will be distributed over the bottom slab.

Pressure Relief Valves

Each tank will be provided with pilot-operated pressure relief valves having Teflon seat and seals. The valves will relieve from the inner tank vapor space.

Vacuum Relief Valves

Each tank will be provided with pallet-type vacuum relief valves.

Utility Summary

Seawater system

The seawater will be filtered through screens and treated with hypochlorite solution that is generated by an electro-chlorination unit. Three (3; plus one installed spare) seawater intake pumps will supply the ORVs.

The intake velocity of the seawater will be limited to 0.5 feet per second (ft/sec; 0.15 m/s).

Dispersion of the seawater return should be limited to a maximum drop in seawater temperature of 5.5ºF (3ºC) at 330 ft (100 m) distance from the discharge location. To meet this specification, the temperature drop of the seawater in the ORVs will be limited to 18ºF (10ºC) during design conditions. Other seawater users include the electro-chlorination unit, the seawater screens (backwash) and the desalination unit.

Nitrogen

Nitrogen will be required for the following:

- Unloading arm purging;
- Continuous purging of the LNG tank insulation space;
- Purging associated with the LNG tanks;
- Purging of pump wells and junction boxes;
- Relief header purging and tank PRV tail pipe snuffing; and
- Equipment and line purging, e.g. BOG compressors.

Nitrogen will be produced by means of a nitrogen generator on the facility. The nitrogen will be of sufficient purity to prevent a flammable mixture occurring within the process pipe work.

Fuel Gas System

The fuel gas system will be designed to supply gas at an acceptable flow rate and temperature to the turbine generators. The gas required for the turbine generators will be taken from downstream of the superheaters. The gas will be let down in pressure to 425 to 500 psi (29 to 34 barg). The resulting temperature will be at least 50ºF (28ºC) above the dew point.

Electro-Chlorination Package

Hypochlorite will be injected at the suction of the seawater lift pump to prevent marine growth. An electro-chlorination package will be provided for this function. The concentration of hypochlorite in the seawater discharge will be 0.5 parts per million (ppm) or less.

Firewater System

The fire water system will include two 100% pumps that will feed into a ring main. The pumps will be diesel-driven. The firewater pumps will be supplied via a diesel day tank. The ring main will be maintained at pressure via the use of a jockey pump, supplied from a freshwater firewater tank.

Instrument Air (IA) and Plant Air (PA)

The IA system will consist of two 100% electric motor driven air compressors, two 100% dryer packages, and one IA receiver. The IA compressors will be backed-up using the emergency diesel generator and UPS. IA will meet the minimum standards of the ISA and will be distributed in the process and utility areas.

The IA system will be designed to operate during emergency shutdown conditions. This system will be shutdown only with operator approval; no system will automatically shut down the IA system.

Diesel System

The diesel facilities will consist of a storage tank (seven days supply for critical services) equipped with a heater and two 100% pumps to supply day tanks for the dual-fuel turbine generators, the emergency generator, and the diesel firewater pumps. Diesel fuel will be supplied by boat. The vessels will pump the diesel into the storage tank on the terminal through a diesel loading hose and reel. Diesel transfer pumps will pump the diesel from the tank through high quality filters for the removal of water and particulates. The diesel will then flow through a totalizing meter and distribution piping, and on to the equipment day tanks.

Fresh/Potable Water

Two 100% seawater lift pumps will supply seawater for the fresh and potable water systems. The seawater will enter the lift pumps through the seawater intake system. Downstream of the pumps, the seawater will be strained with self-cleaning strainers. The pumps will feed the electro-chlorination unit and desalination package.

The desalination unit will consist of two 50% reverse osmosis (RO)-type units to produce potable water from seawater. Potable water will enter directly into the potable water tanks while excess/reject water will be returned overboard. The potable water will be collected in a storage tank and distributed on demand. The potable water system will be sized based upon current manpower loading forecasts of the facility and other known users of potable water.

The potable water will meet the FDA’s requirements for potable water. The system will be designed with a break tank to prevent contamination of the potable water system from non-sterilized sources. Flushing connections for long runs of piping will be provided to allow replenishment of the water in the line with newly sterilized water.

General Facilities

Process Drainage System

Several types of drains will be associated with the facility including:

- Deck drainage:
  - LNG areas; and
  - Utility areas.
- Sanitary (sewage) waste.
- Domestic (graywater) waste.
- Desalinization unit.
- Chemically treated water.

The drainage system will be operated in a manner to ensure that the facility will not discharge liquid hydrocarbons that result in a sheen on the sea surface. In addition, the facility will not discharge floating solids, visible foam, garbage (other than domestic waste as defined in the NPDES permit), dispersants/surfactants/detergents (other than minimal amounts as necessary to comply with the Occupational Health and Safety Act of 1970 (OSHA) and/or MMS safety requirements. Compliance with the conditions of the NPDES permit is mandatory and non-compliance is a violation of the CWA and is reportable.

Deck Drainage

Deck drainage on the facility will be handled according to the location, the potential for the presence of liquid hydrocarbons, and the potential for LNG spills from cryogenic equipment and systems. Daily observations and recordings will be made to ensure that no visible sheen is on the water surface.

LNG Handling Areas

In areas with potential for LNG spillage, such as around the LNG unloading arms, LNG send-out pumps, and ORVs, the LNG spill disposal strategy will be followed. The recommended strategy for handling LNG spills is to direct major LNG spills safely overboard into the sea where the majority of the LNG will vaporize on the sea surface, well away from the facility deck. Smaller spills will vaporize through aerosols formed by the mechanical and thermal break-up of jets. Deck curbing, stainless steel drip pans, and stainless steel drain systems will be employed at likely contact areas to ensure spills are directed overboard to protect important process equipment and structures and structural cold protection for important structures.

The nature of the GBS will allow for gravity draining of LNG from topsides process equipment back to the LNG storage tanks, when required (e.g., during maintenance or a hurricane). The unloading lines and manifold will be self-draining into the tanks. The process equipment will be drained by means of a drain header that will run back into the tanks. The topsides of the GBS can thus be rapidly emptied of LNG in case of emergency.

Utility Areas

Drains from the utility areas (power generation, boil-off gas compressor, emergency diesel generator, diesel day tank, and diesel loading area) where there is a potential for the presence of non-LNG liquid hydrocarbons will be routed to the corrugated plate interceptor (CPI)-type oily water separator. The CPI will be a compact, single-stage, gravity-type vessel using a coalescer plate pack principle of separation. The oily water will gravity drain into the separator where the majority of the oil will separate in the gravity stage below the oil chamber. The water will flow through a multi-stage plate pack, which will encourage the remaining oil droplets to coalesce and rise through the pack to the oil chamber. Oil will be pumped via a closed drain header to a storage tank. From here, it will be pumped into portable tote tanks for transport to shore for recycle or proper disposal. Clean water will exit the rear end of the unit to an overboard discharge connection. Capacitance probes will be fitted to detect the oil level in the oil chamber, controlling the pump to provide automatic operation.

Sanitary (Sewage) Waste

The sanitary (sewage) waste treatment system will consist of the following components:

- Sewage treatment unit;
- Tablet chlorinator; and
- Hydraulic macerator.

The sewage treatment unit will process the blackwater and graywater sewage from the bathrooms in the quarters building (toilets, showers, and hand basins). During maintenance of the sewage treatment unit, the blackwater from the quarters building will bypass the treatment unit and flow through the tablet chlorinator. The chlorinator will contain chlorine tablets that dissolve into the wastewater and kill the bacteria maintaining 1-millligram per liter (mg/L) of total residual chlorine. The hydraulic macerator will contain baffle plates with pressurized seawater jets directed at the baffles. The seawater jets will break up solids in the wastewater stream before it is discharged overboard. Daily observations will be made to ensure no floating solids. One grab sample will be made per month and residual chlorine concentration will be recorded.

Domestic (Graywater) Waste

Domestic (graywater) waste including any discharge from galleys, sinks, safety showers, eye wash stations, hand wash stations, and laundries also will be discharged overboard. Daily observations will be made to ensure no floating solids. Ground food waste will be passed through a minimum 1-inch screen. Graywater from the bathrooms in the quarters (showers and hand basins) will be directed to the sanitary (sewage) waste system as described above.

Desalinization Unit

Desalinization unit (reverse osmosis water maker) discharges of either fresh or salt water will be discharged overboard. Weekly visual observations will be made to ensure no visible sheen. The observations will be recorded.

Chemically Treated Water

The seawater used as heating medium in the ORVs will be defined as chemically treated water and will be discharged through an outfall located to the south of the terminal. The seawater is treated with sodium hypochorite by injection at the suction of each seawater lift pump to control the growth of marine life in the pumps, piping, and downstream equipment. An electro-chlorination package will be provided for this function.

Visual observations will be made to ensure no visible sheen on the water surface. Monthly toxicity testing will be initially performed for 12 months, followed by annual toxicity testing. The maximum discharge concentration of sodium hypochlorite will be 0.5 ppm in accordance with USEPA product labels and manufacturers recommendations.

Other Wastes

Other non-hazardous solid wastes and all plastics will be transported to shore for disposal in a state-approved municipal or industrial trash facility. Hazardous wastes will be collected and isolated from non-hazardous wastes, and transported to shore for proper processing or disposal.

Maintenance and Material Handling

All aspects of maintenance and material handling will be considered, including accessibility and maintainability, in the general arrangement and selection of materials handling devices. Formal HFE maintainability and accessibility reviews will be conducted to identify appropriate types and numbers of equipment handling devices. Such devices might include monorails, judicious use of pad eyes for leveraging lifting devices, hatches, dollies, clear passageways, pedestal and mobile cranes, etc. The use of these devices will ensure that all equipment can be accessed for in-place maintenance and/or removal. Any piece of equipment that weighs in excess of 55 pounds (25 kilograms) will be provided with a means of removal via a lifting device.

Operations and engineering will collaborate in determining the appropriate style of maintenance (e.g., planned, predictive, run-to-failure, etc.) for each piece of equipment, taking availability requirements, criticality, production uptime, cost of failure and safety into account. The appropriate level of conditioning monitoring will be provided for each piece of equipment as defined by the style of maintenance chosen for that piece of equipment. Engineering will support operations in the preparation of all necessary maintenance procedures, recommended spare parts lists, and pertinent manufacturer's information. Additional information on maintenance items is provided in Attachment N, "Operations Philosophy" {*confidential*}.

Power Generation and Electrical System

Turbine Generators

The facility will generate its own power and no electrical power will be imported. The electrical load required is estimated at 17-MW design capacity at peak send-out rate. Electrical power will be generated by two (ISO-rating) turbine generators. One additional turbine will be installed as a spare.

At least one turbine will be provided with dual-fuel nozzles for diesel start-up when required (e.g., after a hurricane). Low NO_x burners will be specified for the turbine generators.

Waste Heat Recovery Unit (WHRU)

The waste heat generated by the turbines will be used to heat water, the heating medium of the superheater. The water will be circulated through the closed-loop system through coils in the stack and returned to the superheaters. The maximum duty required (governing case for the WHRU) is to supply sufficient duty to heat the maximum gas flow from 34 to 95ºF (1 to 35ºC) coincident with lowest seawater temperature. To meet this requirement a small auxiliary boiler will be provided for use in the winter months.

To protect the hot water coils from overheating (e.g., when a turbine generator is started up when the superheater is not in operation) a flue bypass system will be used. Each turbine generator will have its own WHRU with a single water loop connecting to all WHRUs and superheaters in parallel.

Power Distribution

The primary distribution voltage will be 60 Hertz (Hz) 13.8 kilovolt (kV), feeding 4.16 kV (for large motor drives) and 480 volt (V) switchboards (for smaller motor drives and other package electrical equipment). Lighting and small power voltage will be 120V/208V 1-phase. Control and instrumentation voltages will be 120V 1-phase and 24V DC. A load-shed system will be installed to protect the electrical system in the event of the protective tripping of one of the running generator sets to avoid a cascade-trip of the complete electrical facilities.

Emergency and Vital Supplies

Emergency power will be supplied from the emergency diesel generator (EDG). The EDG will be sized to supply the emergency loads on failure of the normal power generation, with automatic run-up and connection to the emergency electrical supply system. The EDG may be used to power selected loads for periods of facilities abandonment during severe weather. A subset of the emergency loads, deemed as vital, will be fed from UPS units with battery backup. The UPS units will be fed from the emergency bus.

2.17.8
148.105(q)(8)
Personnel Capacity of Pumping Station Complexes

An accommodation module will be installed at one end of the GBS in a location such that no part of the building will be directly above an LNG tank. Special measures including firewalls and bulkheads, firefighting and escape systems will be included to ensure personnel protection. The quarter's capacity will be 60 persons in two-person cabins. The normal operating crew will be about 30 with additional capacity available for installation, commissioning, maintenance, and other temporary personnel. Lifeboats will be provided at three locations on the platform for 100% personnel capacity (total 300% capacity). A heliport, located above the quarters building, is designed to suit a Sikorsky S-76 helicopter or equivalent with an adjacent helicopter parking area.

2.18
148.105(r)
Data on Offshore Pipelines

2.18.1
148.105(r)(1)
Description and Design Drawing of Marine Pipelines

Up to five new takeaway pipelines, totaling approximately 65.7 miles (105.73 km), will be constructed to connect the terminal to the existing offshore pipeline infrastructure. The pipelines will operate at approximately 1,218 psi (84 bar) and have a combined delivery capacity of 3 billion standard cubic feet per day (Bscfd; 85 MMscmd). The pipelines will be located in water depths varying from 40 to 60 ft (12.19 to 18.29 m) and will be buried to meet the regulatory standards of an equivalent 36 inches (0.91 m) of cover except that pipelines crossing shipping fairways will be buried with 10 ft (3 m) of cover. The pipelines will be installed using a shallow-draft lay barge and trenched by a barge equipped with a trenching spread thereafter. All required permits and clearances will be obtained before construction begins.

- Pipeline ‘A’ will have a capacity of 800 MMscfd (22.7 MMscmd) operating at 1,218 pounds per square inch gauge (psig; 84 barg) with an outside diameter of 36 inches (0.91 mm). Pipeline ‘A” will be approximately 20.0 miles (32.19 km) in length.
- Pipeline ‘B’ will have a capacity of 500 MMscfd (14.2 MMscmd) operating at 1,145 psig (79 barg) with an outside diameter of 24 inches (0.61 m). Pipeline ‘B” will be approximately 13.0 miles (20.92 km) in length.
- Pipeline ‘C’ will have a capacity of 500 MMscfd (14.2 MMscmd) operating at 1,203 psig (83 barg) with an outside diameter of 30 inches (0.76 m). Pipeline ‘C” will be approximately 17.2 miles (27.68 km) in length.
- Pipeline ‘D’ will have a capacity of 500 MMscfd (14.2 MMscmd) operating at 1,218 psig (84 barg) with an outside diameter of 16 inches (0.41 m). Pipeline ‘E” will be approximately 1.7 miles (2.74 km) in length.
- Pipeline ‘E’ will have a capacity of 300 MMscfd (8.5 MMscmd) operating at 1,160 psig (80 barg) with an outside diameter of 20 inches (0.51 m). Pipeline ‘E” will be approximately 13.8 miles (22.21 km) in length.

Drawing No. 03-003-1008 in Appendix F shows the proposed pipeline routes.

In discussions with representatives of the MMS, a potential issue was identified regarding the effect of commingling gas from a non-federal source (i.e., the revaporized LNG) with flowing gas production from federal sources that contains liquids or liquefiable content. The commingling would occur within the existing offshore pipelines connected to the terminal. The MMS has a process whereby a designated producer representative on the pipeline can initiate a commingled system application to MMS addressing the commingling of the revaporized LNG into the existing infrastructure and make any appropriate changes to allocation procedures utilized by such pipeline. Representatives of the MMS and Applicant recognize that the commingling issue will be addressed through these MMS reviews, which will be initiated separate and apart from this license application.

All pipelines will undergo a hydrostatic test to prove the strength after construction and before being placed in operation. Hydrostatic tests will be performed in accordance with CFR 192, ASME B31.8, and API 1110. As defined within the codes, test factors depend upon class location of the pipeline. Class definitions are provided in Sections 192.5 and 840.22 of the CFR and ASME codes, respectively.

For the riser sections of the pipelines both codes define this section of the pipeline as a Class 3 location. The test factors differ slightly between the two codes. ASME B31.8 states a factor of 1.4 in Section A847.2. CFR 192 requires a factor of 1.5, as defined in Section 192.619, which is thus governing. For the pipeline section both codes define this area as a Class 1 location. The CFR requires a factor of 1.1 and the ASME code requires a factor of 1.25; therefore, the ASME code governs.

2.18.2
148.105(r)(2)
Design Criteria of Marine Pipelines

The pipelines will be designed for a maximum allowable working pressure of 1,440 psig (99.3 barg) and will be located in water depths varying from 40 to 60 ft (12.2 to 18.3 m). The pipelines will be constructed of API 5L line pipe having a specified minimum yield stress (SMYS) of 52,000 psi (358.5 mega Pascal [MPa]) or greater. The pipelines will be constructed in accordance with 49 CFR § 192.327(g) and § 192.612(b)(3) requiring all natural gas pipelines in the GoM to have a minimum of 36 inches (0.91 m) of cover for normal excavation and 18 inches (0.46 m) of cover for rock excavation, except that pipelines crossing shipping fairways will be buried with 10 ft (3 m) of cover. For undersea stability, the pipeline will have an appropriate weight concrete coating. The corrosion protection system will include a thin film external coating and sacrificial anodes. The design life of the pipelines is at least 30 years.

2.18.3
148.105(r)(3)
Design Standards and Codes for Marine Pipelines

The new pipelines will be designed to withstand stresses during installation, testing, and operations. The pipelines will be designed, constructed, tested, operated, and maintained in accordance with 49 CFR Part 192 and the standards incorporated by reference therein. The specification break between the topside and down stream piping will occur at the temporary pig launcher. All upstream piping will be designed in accordance with ASME/ANSI B31.3. All piping downstream of the temporary pig launcher, including the temporary pig launcher itself, will be designed according to ASME/ANSI B31.8. The pipelines will be designed according to API RP 1111.

2.18.4
148.105(r)(4)
Engineering Practices for Marine Pipelines

Specific design standards, codes, and recommended engineering practices to be followed include:

- American Petroleum Institute (API):
  - API RP 1111, Design, Construction, Operation, and Maintenance of Offshore Hydrocarbon Pipelines;
  - API RP 1110, Pressure Testing of Liquid Petroleum Pipelines;
  - API 1104, Welding of Pipelines and Related Facilities;
  - API 5L, Line Pipe; and
  - API 6D, Pipeline Valves (Gate, Plug, Ball, and Check Valves).
- American Society of Mechanical Engineers (ASME):
  - ANSI B31.3, Process Piping; and
  - ANSI B31.8, Gas Transmission and Distribution Piping Systems.

2.18.5
148.105(r)(5)
Metering System for Marine Pipelines

The vaporized LNG will be metered and regulated for pressure flow control by equipment dedicated to each of the takeaway pipelines. Each of the metering stations will utilize one or more 10-inch (0.25-m) nominal meter tubes to accurately measure expected flowrates. Another meter tube and meter will be provided as an uninstalled spare on the platform. There is no odorizing requirement for the export gas.

2.18.6
148.105(r)(6)
Submerged or Buried Pipelines Crossed by Marine Pipelines

The proposed pipeline routes were selected to minimize distance and crossings of existing pipelines while avoiding existing platform structures. A route and hazard survey has been performed to identify any underwater hazards in the pipeline routes and to locate the exact location of subsea cable or pipeline crossings (see Attachment I {*confidential*}). Any identified hazards will be avoided or removed.

The proposed pipelines will traverse fifteen (15) existing pipelines and eight abandoned pipelines. Divers or remotely operated vehicles (ROVs) will be used to locate and monitor these pipeline crossings during pipeline construction.

The pipelines will be constructed in accordance with the requirements of 49 CFR § 192.325, which mandates 12 inches (0.30 m) of clearance from all other underground structures. The pipeline will be installed over the tops of existing pipelines/cables. In some cases, it may be necessary to lower existing pipelines in order to achieve the required clearance between the new and existing pipelines. Sandbags and/or concrete mats will be used to ensure 18 inches (0.46 m) of separation between the pipelines. In the event that the installation results in less than 36 inches (0.91 m) of cover over the new pipelines, concrete mats will be used to provide an equivalent degree of protection. All crossings will be coordinated with the relevant pipeline owners/operators and the MMS.

Should any cables be found, industry standard protective crossing procedures, as agreed by cable owners when applicable, will be implemented.

2.19 148.105(s) Data on Onshore Components

U.S Coast Guard regulations at Section 148.105(s) [May 30, 2002, *Federal Register*] seek information related to descriptions and locations of onshore facilities (new and existing) that will be served by the deepwater port including pipelines, storage facilities, refineries, and petrochemical facilities. In addition, this section requires throughput reports for the calendar year preceding the date of the application for crude oil and refined products.

Applicant is not proposing any new onshore facilities as part of its deepwater port. In addition, Applicant cannot identify existing onshore facilities that may be served by regasified LNG originating at Applicant's deepwater port. Natural gas is a fungible commodity. As a result, regasified LNG from the Gulf Landing terminal can be blended or interchanged with domestic-produced natural gas. The natural gas pipeline industry delivers equivalent energy quantities of natural gas on a contract basis–not specific molecules. The onshore natural gas pipeline grid can facilitate delivery to any demand market served by such grid. Thus, the facilities that will be served by the regasified LNG cannot be identified, nor can the ultimate consumer destination.

Section 148.105(s)(3) requires throughput reports for the calendar year preceding the date of the application. SNALNG, an affiliate of Gulf Landing LLC, will hold 100% of the proposed deepwater port's storage and regasification capacity. Once the Gulf Landing terminal becomes operational, daily throughput (send-out) is expected to average approximately 1 Bcfd. SNALNG holds capacity at other U.S.-located LNG terminals; however, throughput reports for these terminals are not available because the reserved capacity was not operational in 2002.

2.20 148.105(t) Data on Miscellaneous Components

2.20.1 148.105(t)(1) Communications Systems

The following telecommunications systems and equipment will be provided on the terminal:

- A broadband digital microwave link to Shell's offshore voice and data network to connect the facility's telecommunications systems with shore-based systems;

- A satellite system as an emergency telephone and data link to be used in the event of a total microwave system failure;
- A digital private automatic branch exchange (PABX) for communications with Shell and public telephone systems on shore via the Shore Link;
- An ethernet local area network (LAN) on the facility that will interface with Shell's wide area network (WAN) via the Shore Link;
- An ultra high frequency (UHF) radio repeater system to enable facility-wide communications between the central control room, operations and maintenance personnel, cranes, LNG carrier, supply boats, and helicopters;
- A marine VHF radio for communications with approaching LNG carriers, supply boats, and berthing tugs;
- An aeronautical radio for communications with incoming/outgoing helicopters; and
- Emergency VHF marine radios, EPIRBs, and SARTs on all lifeboats, rescue boats, and rafts.

2.20.2
148.105(t)(2)
Radar Navigation System

The terminal will be equipped with an active 3-gigahertz (GHz [S-band]) radar scanner with associated automatic radar plotting aids (ARPA)-capable display unit to display moving (and stationary) targets within a minimum 20-mile (32-km) radius range of the terminal. This unit will minimize potential collisions between seagoing vessels and the facility. The radar will allow operating personnel to observe approaching ships and vessels and contact them by radio or other appropriate means when they are within the terminal precautionary area, and safety zone or otherwise an unsafe distance from the facility.

2.20.3
148.105(t)(3)
Vessel Bunkering Methods

There will be no provisions for bunkering at the Gulf Landing terminal.

2.20.4
148.105(t)(4)
Vessels for Bunkering, Mooring, and Servicing Vessels Using the Deepwater Port

No bunkering vessels will be in use at the Gulf Landing terminal.

2.20.5
148.105(t)(5)
Shore-Based Support Facilities for the DWP's Bunkering, Mooring and Servicing Vessels

Regular marine support and supply for the terminal will be provided by contracted marine services and call out contracts will be used for non-routine or occasional marine support requirements. An assessment of the marine support facilities required will be determined in a marine support study to be performed during the detailed design of the facility. It is anticipated that existing marine support infrastructure will be used.

The following types of marine support will be required:

- Permanent marine support:
  - Standby vessels (if justified); and
  - Supply vessels or suitably modified tugs.
- Occasional marine support:
  - ROV/diving support; and
  - Maintenance/crane support.

A marine services contractor will be required to provide and manage the necessary supply and support vessels.

During a logistics study to be performed during the detailed design of the facility, a review of existing shore facilities for the purposes of performing supply and support operations will be required for Gulf Landing operations. It is expected that an existing logistics/supply base will be contracted for by the Applicant. In selecting a suitable logistics supply base, the following facilities and items will require consideration:

- Transit time to the facility;
- Established road, rail, and air links;
- Covered warehousing for storage of materials;
- Bulk storage facilities for liquids required offshore;
- Open, secure storage area for larger materials;
- Wharfage and craneage of sufficient load bearing capacity for the handling of stores and equipment;
- Available water depth to allow the operation of supply vessels;
- The presence of hazards to navigation; and
- Weather downtime in the port facility.

An existing helicopter base at a suitable location will be used to service the facility.

2.21
148.105(u)
Construction Procedures

The two caissons forming the GBS will be constructed in a purpose-built graving dock most likely located somewhere in the GoM or Caribbean. Both GBS caissons will be constructed simultaneously with access to a single graving dock. The GBS construction scope includes the installation of the LNG containment system and the installation/integration of the topsides facilities equipment. Once the construction scope is complete the casting basin will be flooded by removing the entrance berm by a combination of excavation and dredging. Any additional dredging required to reach the shipping channel would then be performed. The first caisson will be towed to site and installed before the second caisson is towed to location. The remainder of the installation activities will begin after the second GBS caisson is installed and will include: 1) installation of solid ballast material; 2) placement of the scour protection; 3) installation of the seawater intake and outfall structures; 4) hookup and pre-commissioning of the topsides facilities; and 5) hookup and commissioning of the takeaway pipelines (which will be preinstalled before the installation of the GBS caissons). Once these activities are complete a partial shipment of LNG will be used to start-up and commission the terminal. Additional information on the fabrication and installation approach is contained in Attachment M {*confidential*}.

2.22
148.105(v)
Operations Manual

A preliminary Operations Philosophy for the terminal has been developed and is included as Attachment N *{confidential}* to this application. A preliminary Marine Operations Manual is included as Attachment O *{confidential}* and a preliminary Security Plan is included as P *{confidential}*. The intent of these documents is to provide a guide to the proposed method and philosophy of operating the terminal. As work proceeds on the detailed design of the terminal, operating personnel will be assigned to the project team and a more detailed final operating manual will be prepared. Prior to commencement of operations, the final operating manual will be submitted to Commandant (G-M) for approval pursuant to U.S. Coast Guard regulations. Once approval is received, the operating manual will be available on the terminal for use by personnel and a copy will be maintained with the U.S. Coast Guard Captain of the Port in Port Arthur, Texas.

2.23
148.105(w)
Environmental Review

An environmental review (ER) has been prepared in support of this application. The ER analyzes the potential environmental consequences of implementing the proposed action, its cumulative environmental effects, and the need for mitigation measures. Unavoidable adverse impacts and irreversible and irretrievable impacts are also identified. Further, the ER addresses:

- Shell's purpose and need for developing this project;

- The reasonable alternatives considered in developing the project, including system and location alternatives; and,
- The existing environmental conditions at alternative locations.

The complete ER is provided as Volume II of this application.

2.24
148.105(x)
Aids to Navigation

2.24.1
148.105(x)(1)
Proposed Positions of Navigational Aids

Gulf Landing will obtain U.S. Coast Guard authorization to establish aids to navigation associated with the deepwater port. Authorization also will be obtained from the U.S. Coast Guard for establishing a safety and/or security zone around the port and to establish the carrier routes or anchorage areas associated with the Gulf Landing terminal.

Information on appropriate floating navigation aids will be filed with the U.S. Coast Guard District 8 office at a later date.

2.24.2
148.105(x)(2)
Descriptions of Proposed Obstruction Lights and Rotating Lighted Beacons

In addition to general deck lighting, the fixed structure will be equipped with navigation warning lights and aviation warning lights. The navigation lights will be provided as required by 33 CFR Part 149 Subpart E, Aids to Navigation.

Aviation warning lights will be installed on the terminal’s vent tower and other tall structures (e.g., fixed cranes). These lights and their controller will meet all FAA and FCC requirements. Alternating blue and yellow omni-directional taxiway lights will be installed to outline the heliport landing area.

Initially, the terminal will be fitted with twelve (12) obstruction lights arranged as shown on the attached site plan (*see* Drawing No. 03-003-7000; Attachment D {*confidential*}). Each of the terminal’s obstruction lights will be an assembly consisting of one or more marine lanterns that will meet the intensity, flash interval, and vertical divergence requirements of 33 CFR § 149.521 through § 149.527, respectively. Each fixed structure obstruction light will be installed approximately 75 ft (23 m) above mean water level.

2.24.3
148.105(x)(3)
Descriptions of Proposed Fog Signals

The terminal will have a main 2-mile (3.22-km) and standby 0.5-mile (0.8-km) U.S. Coast Guard-approved foghorn located at each end of the facility. The foghorns will meet the requirements of 33 CFR § 149.799 and will be installed at a height of approximately 75 ft (23 m) above the sea level. The signal will transmit a Morse letter 'u' at 30-second intervals with 133.4 decibel at 1m at 800 Hz. The foghorns will be electrically powered from the terminal UPS system with battery backup.

2.24.4
148.105(x)(4)
Descriptions of Proposed Buoys

No permanent floating structures will be associated with the terminal. The location of the submerged seawater outfall will be marked using a lighted isolated danger buoy.

2.24.5
148.105(x)(5)
Description of the Proposed Radar Beacon

The terminal will be equipped with an FCC-type dual band radar beacon operating at 9.3 to 9.5 Ghz (X-band) and 2.9 to 3.1 GHz (S-band). The beacon will meet the requirements of 33 CFR § 149.795, will have a transmitter power of 1 watt, and will have an adjustable sensitivity to –50dBm. The racon will be omni-directional and polarized in the horizontal plane. The racon will be installed at a height of at least 4.5 m above the level of the helicopter deck and will return a two-element Morse character that provides identification of the beacon, as well as range and bearing. The range of the beacon will depend on several factors, including the height and power output of the radar system triggering the response. Typically, a range of 15 miles may be achieved. The racon will be powered from the terminal's UPS system with battery backup.

2.25
148.105(y)
Telecommunications Equipment

The following telecommunications systems and equipment will be provided on the terminal:

- A broadband digital microwave link to Shell's offshore voice and data network to connect the facility's telecommunications systems with shore-based systems;
- A satellite system as an emergency telephone and data link to be used in the event of a total microwave system failure;
- A digital PABX for communications with Shell and public telephone systems on shore via the Shore Link;
- An ethernet LAN on the facility that will interface with Shell's WAN via the Shore Link.
- A closed-circuit television (CCTV) system with monitors and control in the central control room to monitor carrier berthing, plant operations, and supply activities.

- A telecommunications supervisory system provided by the DCS.

2.26
148.105(z)
National Pollutant Discharge Elimination System

Section 402 of the CWA establishes the NPDES to authorize the issuance of permits for discharges into U.S. waters (33 USC 1342). Section 402 is specifically extended to the OCS by the terms of Section 403, which provides guidelines for the USEPA to issue permits for discharges into the territorial sea, the contiguous zone, and ocean waters further offshore (33 USC 1393). Section 403 of the CWA also requires that USEPA NPDES permits for discharges into the territorial seas, contiguous zone, and the oceans be issued in compliance with the USEPA's guidelines for determining the degradation of marine waters.

The USEPA NPDES permit application to discharge process wastewater, EPA Form 3510-2D (Form 2D), as well as, EPA Form 3510-1 (Form 1) are included in Appendix G for coverage under the USEPA's NPDES permitting program. The EPA forms and the Gulf Landing deepwater port application should constitute the basis of a complete application in order for Gulf Landing to obtain the necessary USEPA NPDES permit.

In assessing the potential effects of discharges associated with the Gulf Landing terminal, such as thermal water usage, USEPA will evaluate the impacts on the biological community. The analyses of these specific discharges are provided in the environmental review included in Volume II of this application. This provides USEPA with the necessary information in which to conduct the ocean discharge evaluation under the provisions of Section 403.

2.27
148.105(aa)
USACE Dredge and Fill Permit

Section 10 of the Rivers and Harbors Act of 1899 (33 USC § 403) requires a permit for any obstruction or alteration occurring in navigable waters of the United States. The United States Army Corps of Engineers' (USACE's) authority under Section 10 was extended to the construction of artificial islands, installations, and other devices on the seabed, to the seaward limit of the OCS, by Section 4(f) of the Outer Continental Shelf Lands Act of 1953, as amended (43 USC §§ 1331 et seq.). Section 404 of the Clean Water Act (33 USC § 1344) also regulates the discharge of dredged and fill material into waters of the United States, including wetlands. The requirements of Sections 10 and 404, for both offshore and onshore effects to wetlands and navigable waters, are covered by one permit application.

Gulf Landing will submit a permit application ("ENG FORM 4345") along with drawings and the environmental review to the USACE, New Orleans District office. Based upon discussions with a representative of the USACE, the Gulf Landing Section 10/Section 404 permit application will be filed separate and apart from the deepwater port license application. Gulf Landing intends to submit the Section 10/Section 404 filing within fifteen (15) days of the U.S. Coast Guard's notice published in the *Federal Register* pursuant to Section 5(c)(1) of the DWPA. A copy of the submittal will be forwarded to the Commandant [G-M] U.S. Coast Guard in Washington, D.C. at that time. Even though the location of the site is outside of the coastal zone, Gulf Landing will also forward a copy of the Section 10/Section 404 permit application to the Louisiana Coastal Management Division for the state's review under federal consistency.

In addition, should construction of the Gulf Landing terminal facilities be undertaken within the United States, a separate filing pursuant to Section 401 of the Clean Water Act will be made with the USACE covering any proposed dredge or fill activities related to the construction site. A copy of this filing will also be submitted to the relevant State authorities and to the Commandant [G-M] U.S. Coast Guard in Washington, D.C. at that time.

2.28 148.105(bb) Additional Federal Authorizations

Gulf Landing is aware that other federal authorizations and/or consultations are likely to be necessary during the license approval process. These actions expected for the construction and operation of deepwater ports are described below.

United States Coast Guard

Gulf Landing will obtain U.S. Coast Guard authorization to establish aids to navigation associated with the deepwater port. Authorization also will be obtained from the U.S. Coast Guard for establishing a safety and/or security zone around the port and to establish the carrier routes or anchorage areas associated with the Gulf Landing deepwater port.

Minerals Management Service

Gulf Landing understands that right-of-way easement conditions (including compliance with the National Historic Preservation Act) might be included in MMS comments provided to the U.S. Coast Guard regarding this deepwater port license.

U.S. Environmental Protection Agency

USEPA is the jurisdictional authority for air quality permitting. The estimated emissions from the Gulf Landing project for all criteria pollutants (carbon monoxide [CO], NO_x, sulfur dioxide [SO_2], particulate matter of 10 microns or less [PM_{10}], volatile organic compounds [VOCs] and lead) and Hazardous Air Pollutants (HAPs) are below major source air emission thresholds (250 tons per year [TPY] for individual criteria pollutants, 25 TPY for total HAPs, and 10 TPY for individual HAPs); therefore, no Prevention of Significant Deterioration (PSD)/New Source Review Construction Permit is required. Based on discussions with USEPA, Gulf Landing will restrict operating hours of standby equipment to ensure the facility will not exceed the major source threshold (a "synthetic minor" permit).

However, the project will require a Federal Title V Operating Permit (40 CFR Part 70) from USEPA Region 6 (as administered by the Louisiana Department of Environmental Quality rules) since emissions of one or more of the criteria pollutants exceed 100 TPY. Although USEPA will be the permit issuance authority, Louisiana will be included in the review process. The USEPA Air Quality Permit Application, including 40 CFR Part 71 Federal Operating Permits Program forms, is included in Appendix H.

NOAA Fisheries

Gulf Landing will initiate information consultation with the National Oceanic and Atmospheric Administration Fisheries Division (NOAA Fisheries; formerly the National Marine Fisheries Service [NMFS]) regarding any potential effects on essential fish habitat (EFH) or threatened and endangered species from construction of the port and associated pipelines. NOAA Fisheries will also be consulted regarding any requirements under the Marine Mammal Protection Act.

U.S. Fish and Wildlife Service

Gulf Landing will initiate consultation with the U.S. Fish and Wildlife Service (USFWS) to ensure there are no effects to threatened and endangered species from construction of the port and associated pipelines.

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2.29
148.105(cc)
Statement Certifying Application

CERTIFICATION

STATE OF TEXAS)

COUNTY OF HARRIS)

Pursuant to Section 148.109(d) of the United States Coast Guard's Regulations, the undersigned, A. Y. Noojin, III, having been first duly sworn, deposes and says that he is President of Gulf Landing LLC, that he has read the filing, signed and knows its content, that to the best of his knowledge, information and belief, the facts set forth in said filing are true, and that he possesses full power and authority to sign this certification.

A. Y. Noojin III

A. Y. Noojin, III

Sworn to and subscribed
Before me this 21st day
of October 2003.

Rebecca Rodriguez

Notary Public
My Commission expires: March 23, 2005

[seal]

REBECCA RODRIGUEZ
Notary Public, State of Texas
My Commission Expires
MARCH 23, 2005